

## **SPECIFICATIONS**

For: CANTAPORTS

Job Number: S853595

**Revision Number: 0** 

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**Project Engineer** 

BEng (Hons) DIS,. M.I.E (Aust)

Date: 23 August 2017

























Structerre reference number: \$853595

Client reference number:

24 August 2017

Cantaports Unit 2/9 Principal Place MALAGA WA 6090

Dear Emmanuel

### SERIES 4000, 5000, 5700, HAND CALCULATIONS AND PURLINS SPECIFICATIONS

Please find attached the specifications requested. Thank you for the opportunity to assist you in this matter. If this Office can be of further assistance or if clarification is needed on any comments in this report, please do not hesitate to contact us.

Yours faithfully

Ashley List Project Engineer

BEng (Hons) DIS,. M.I.E (Aust)

#### Disclaimer:

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	HAND CALCULATIONS	
	PURLINS	



1. 4,000 SERIES

#### STATIC REPORT

PJR-series

4330-H23

#### 1. Material and Evaluation

#### 1)Post

Materi A6063S-T6(SS)

Material performance

	Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
L	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
1	DE8388	13.90	563.62	173.23	75.15	36.47	70000	3.53	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb + \sigma c/fc =$ 

0.62 < 1.0 OK!

Wind blow up

 $\sigma$  b/fb+ $\sigma$  c/fc=

0.62 < 1.0 OK!

Wind blow down

 $\sigma b/fb + \sigma t/ft =$ 

0.70 < 1.0 OK!

2 · lk/i=

115.6 < 140 OK!

#### 2Beam

Materi A6063S-T6(SS)

Material performance

Second section moment Section factor F value Cross-section area Elasticity factor Material (cm2) Ix(cm4) Zx(cm3) Iy(cm4) Zy(cm3) E(N/mm2) i cm N/mm2 DE8393 9.06 231.70 37.37 18.13 70000 180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb=$ 

0.70 < 1.0 OK!

Wind blow up

 $\sigma$  bx/fbx=

0.51 < 1.0 OK!

Wind blow down

 $\sigma$  bx/fbx=

0.68 < 1.0 OK!

#### 3 Main frame

Materi A6063S-T6(SS)

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8579有	1.75	5.80	2.13	2.51	0.93	70000	1.10	180

Material evaluation

 $\sigma b/fb=$ 

0.42 < 1.0 OK!

#### 4 Front frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8401	2.55	12.50	6.91	3.81	2.20	70000	1.65	132

Material evaluation

 $\sigma b/fb=$ 

0.22 < 1.0 OK!

#### **5**Rear frame

Materi A6063S-T5

Material performance

	Material	Cross-section area	Second sect	ion moment	Section factor		Elasticity factor	Cross-section radius	F value
l	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
	DE8404有	2.55	7.70	5.90	2.34	1.82	70000	1.52	132

Material evaluation

 $\sigma b/fb=$ 

0.30 < 1.0 OK!

#### **6**Rafter

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8654+DE8666	1.88	0.36	3.75	0.53	1.48	70000	1.41	132

Material evaluation

 $\sigma b/fb=$ 

0.47 < 1.0 OK!

(7)Side frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8683+DE8412	1.65	0.40	2.00	0.32	0.93	70000	1.10	132

Material evaluation

 $\sigma b/fb=$ 

0.33 < 1.0 OK!

**®**Corner bracket

Materi SPFH590

Material performance

	Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
		(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
	GB8064	8.58	205.21	65.07	28.12	20.34	210000	2.75	420

Material evaluation (without support and side panel Vex=38m/s)

 $\sigma$  bx/fb=

0.52 < 1.0 OK!

 $\sigma$  by/fb=

0.08 < 1.0 OK!

9Main frame connecting parts

Materi A6063S-T5

Material performance

Matarial	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8086	2.77	5.59	1.85	2.87	1.69	70000	0.82	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

**10**Front frame connecting parts

Materi A6063S-T5

Material performance

Material	Gross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8084	2.62	6.94	4.75	2.95	2.26	70000	1.35	132

Material evaluation

T /fs=

0.01 < 1.0 OK!

①Rear frame connecting parts

Materi A6063S-T5

Material performance

ſ	Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
1		(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
	GB8085	1.92	2.92	1.83	1.78	1.40	70000	0.98	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

12Roof material

Material

polycarbonat

 $\max \sigma x =$ 

Material performance

Material	Thickness	Length(short part)	Length(long part)	Inserting	Poisson ratio	Elasticity factor	F value
Macerial	cm	cm	cm	cm	ν	kgf/cm2	kgf/cm2
GB4107	0.18	70.3	296.2	1.89	0.3	21000	551

Material evaluation

Bending volume :Wmax=

1.82 cm

44.44 kgf/cm<sup>2</sup>

< <

 $551.0 \text{ kgf/cm}^2$ 

∴ok! ∴ok!

Necessary depth of insert AL

0.31 cm depth or

1.89 cm

13Roof retainer

Materi A6063S-T5

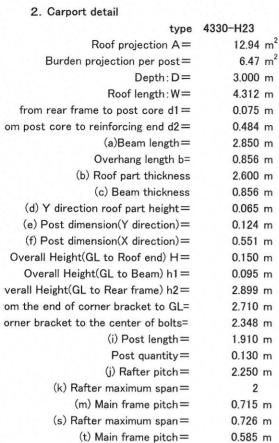
Material performance

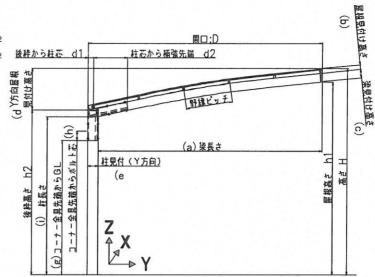
Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Maccriai	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8411	0.79	0.03	1.84	0.08	0.72	70000	1.52	132

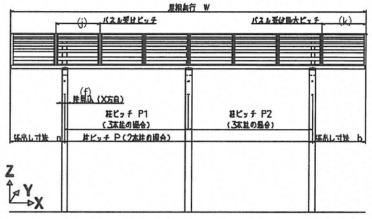
Material evaluation

 $\sigma b/fb=$ 

0.18 < 1.0 OK!







#### 3. Load design

1) Vertical over load (G)

Part Weight

 Roof
 60.0 N/m²

 Post
 36.8 N/m

2Snow over load

Post quantity	Snow area	Snow quantity	Unit weight	Short period snow period
2 posts type	General area	20 cm	$30 \text{ N/m}^2/\text{cm}$	600 N/m <sup>2</sup>

#### 3 Wind blowing load(Vex=38m/s)

· For design of structure frame

Speed pressureq=0.  $6E(Vex \cdot y)^2 =$   $708 \text{ N/m}^2$ Standard wind speedVex= 38 m/s  $E=Er^2Gf=$  1.194  $Er=1. 7(Zb/Z_G)^\alpha =$  0.691Ground surface Div. III

Gust influence factor Gf= 2.5 Zb= 5

 $Z_G = 450$   $\alpha = 0.2$ 

0.3

Installation period factor y= 0.827

· For roof material design

Average speed pressureq' = 0.  $6Er2(Vex\cdot y)^2$  = 283 N/m<sup>2</sup>

4 Earthquake power

Earthquake power Qi=Z·Rt·Ai·Co·Wi

Standard shear power factorCo =

- 5 -

#### 4. Preparing calculation

#### 4-1 Carport load (For earthquake power calculation)

Roof	388	N	
Post	83	N	
Wi=	471	N	

Earthquake power Qi=Z·Rt·Ai·Co·Wi=

141.2 N

#### 4-2 Wind pressure power calculation (Maximum wind power pressure for 1 post)

#### ·For design of structure frame

Wind factor

Independent shed

10°

C=

0.60 (+pressure)

-1.00 (-pressure)

1.2 (Post flat power, side panel)

Wind pressureW=q C=

425 N/m<sup>2</sup>

(Wind blow down)

 $-708 \text{ N/m}^2$ 

(Wind blow up)

849 N/m<sup>2</sup> (Flat)

#### ·Roof material design

Peak with factor calculation process Gpe=

3.1 (+pressure)

3.0 (-pressure: panel center part)

4.0 (-pressure: panel surrounding part)

Peak wind factor Cf=

3.1 x 0.60

1.86 -3.00

3.0 x 4.0 x -1.00 = -1.00 =

-4.00

Wind pressure W=q' Cf=

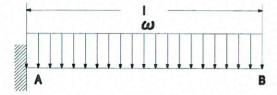
527 N/m<sup>2</sup> -849 N/m<sup>2</sup> (Wind blow down) (Wind blow up)

-1132 N/m<sup>2</sup>

/m<sup>2</sup> (Wind blow up)

#### 5. Beam material examination

#### 5-1 Beam load(without support Vex=38m/s)



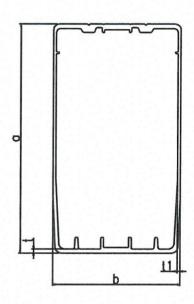
#### Load chart

Туре	Max.			
Vertical load width (m)	Total/post q	uantity	2.156	
I (m)	D-d1-d2		2.441	
Load		Long period load		
ω(N/m)	Short period	129.4 1423.0		
	Short period blowing		1044.9	
	Short period blowing		-1396.5	
	Short period blowing		133.8	
	Short period eartho		129.4	
	Short period earth	- 20-520H 1 1 1 1	38.8	
	Long period		385.4	
	Short period	load	4239.3	
Bending moment	Short period blowing	ng down(vertical)	3113.0	
M(N·m)	Short period blowing	ng up(vertical)	-4160.6	
	Short period blowing	398.5		
	Short period eartho	385.4		
	Short period eartho	115.6		
Maximum bending mon	maxMx	(long period)		
(N·m)		(short period)	4239.3	
	maxMy	(long period)		
		(short period)	398.5	
Second section mome	Ix(cm <sup>4</sup> )		231.7	
	Iy(cm⁴)		60.7	
Section factor	Zx(cm <sup>3</sup> )		37.4	
	Zy(cm <sup>3</sup> )		18.1	
Elasticity factor	E(N/cm <sup>2</sup> )		7000000	
Maximum bending stre	maxσx	- Wes	113.4	
(N/mm2)	max σ y		22.0	
Vertical maximum defo	max δ x	(cm)	3.89	
	max δ x∕I	1/	111	
Flat maximum deforma		(cm)	1.40	
	max δ y∕l	1/	309	

#### 5-2 Beam permissible stress degree Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
b λ ≦b λ p	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

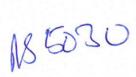
a=	12.40	cm
t=	0.38	cm
t1=	0.15	cm
b=	6.70	
Young's modulus factor E=	70000	N/mm
Shear elasticity factor of bending materialG=	27000	Nmm
Torsion fixed number of bending material=	127.3	cm <sup>4</sup>
Second section moment around weak axis Iy=	60.745	cm <sup>4</sup>
Section factor of bending direction Z=	37.37	cm <sup>3</sup>
F: Standard strength(N/mm2) =	180	N/mm
b λ =√ (My/Me)=	0.14	
$Me=C\sqrt{((\pi^2EIyGJ)/lb^2)}=$	359491633	Nmm
Bending moment My=	6726600	Nmm
$C=1.75+1.05(M2/M1)+0.3(M2/M1)^2=$	1.75	
M2=	0	Nm
M1=	4161	Nm
M2/M1=	0	
lb=	584.7	mm
$b \lambda p = 0.6 + 0.3 (M2/M1) =$	0.6	
bλe=1/√0.5=	1.41	



 $\nu$  =3/2+2(b  $\lambda$  /b  $\lambda$  e)  $^2$ /3 (its value assumes 2.17 in case more than 2.17)  $\nu$  = 1.51

 $\nu = 1.5$   $b \lambda \leq b \lambda p$ 

Permissible stress degree fb:  $F/\nu = 119.5 \text{ N/mm}^2$ 



#### Permissible stress degree at bend parts (strong axis) 1) Frange plate of beam <top/bottom face> $\Gamma$ b : The conversion ratio = b/t • $\sqrt{(F/E)}$ 0.85 a) Γb ≤ 1.34 fb = F/1.5b) $1.34 < \Gamma b \le 2.69$ $fb = F - 0.248F \Gamma b$ c) 2.69 < \Gamma b $fb = 2.41 F/(\Gamma b^2)$ 120.0 N/mm<sup>2</sup> 2) Web plate of beam <side face> $\Gamma d$ : The conversion ratio = $d/t \cdot \sqrt{(F/E)}$ 3.94 a) $\Gamma d \leq 3.29$ fb = F/1.5b) $3.29 < \Gamma d \le 6.57$ $fb = F - 0.101F\Gamma$ c) 6.57 < \Gamma d fb = $14.4 \text{ F}/(\Gamma d^2)$ 108.5 N/mm<sup>2</sup> Therefore, result data is... 108.5 N/mm<sup>2</sup> fbx= fbx= 162.7 N/mm<sup>2</sup> Permissible stress degree at bend parts (weak axis) 1) Frange plate of beam <top/bottom face> $\Gamma b := b/t \cdot \sqrt{(F/E)}$ Гь = 3.94 a) $\Gamma$ b ≤ 1.34 fb = F/1.5b) $1.34 < \Gamma b \le 2.69$ $fb = F - 0.248F \Gamma b$ c) 2.69 < \Gamma b $fb = 2.41 F/(\Gamma b^2)$ 28.0 N/mm<sup>2</sup> 2) Web plate of beam <side face> $\Gamma d$ : The conversion ratio = $d/t \cdot \sqrt{(F/E)}$ 0.85 a) Γd ≤ 3.29 fb = F/1.5b) $3.29 < \Gamma d \le 6.57$ $fb = F - 0.101F\Gamma$ c) $6.57 < \Gamma d$ $fb = 14.4 \, F/(\Gamma d^2)$ 120.0 N/mm<sup>2</sup> fb= Therefore, result data is... 28.0 N/mm<sup>2</sup> fby= 42.0 N/mm<sup>2</sup> fby= Section of the Beam examination Snow for short period 4239.3 N·m M= 113.4 N/mm<sup>2</sup> σb= 0.70 < 1.0 OK! σb/fb= Wind blow down M= 3113.0 N·m 83.3 N/mm<sup>2</sup> $\sigma bx =$ 0.51 < 1.0 OK! $\sigma bx/fbx=$ Wind blow up M= -4160.6 N·m 111.3 N/mm<sup>2</sup> $\sigma$ bx= 0.68 < 1.0 OK! $\sigma bx/fbx=$ Wind blow horizontal

0.52 < 1.0

OK!

398.5

22.0

M= σby=

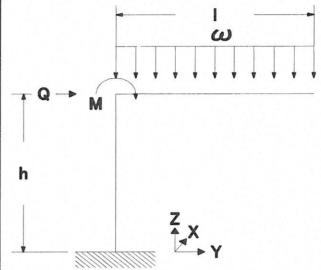
 $\sigma$  by/fby=

#### 6. Post material examination

#### 6-1 Post load

#### Load chart

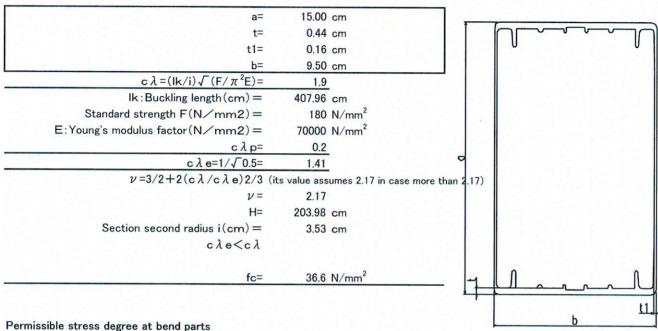
Туре	I	
Vertical load width (m)	Total/post quantity	2.156
I (m)	D-d1	2.850
. ()	Long period load	129.4
Load	Short period load	1423.0
ω(N/m)	Short period blowing up(vertical)	1044.9
ω (14) 111)	Short period blowing down(vertical)	-1396.5
	Short period earthquake(vertical)	129.4
	Long period load	470.8
Axial force	Short period load	4351.6
by vertical load	Short period blowing up(vertical)	3217.4
N(N)	Short period blowing down(vertical)	-4106.8
14(14)		470.8
Flat load	Short period earthquake(vertical)	637.4
Q(N)	Short period wind X Short period wind Y	840.6
G(N)	Short period earthquakeX、Y	116.4
	<del> </del>	525.4
Danding manage	Long period load	5779.0
Bending moment	Short period load	4243.5
M(N·m)	Short period blowing up(vertical)	
	Short period blowing down(vertical)	-5671.6
D 11 1	Short period earthquake(vertical)	525.4
Bending moment	Short period blowing up(vertical)+WindY	6134.9
by vertical and flat load	Short period blowing down(vertical)+WindY	-7563.0
Mx(N·m)	Short period earthquake(vertical) + Earthquak	787.3
Bending moment	Short period windX	1434.2
by flat load	Short period earthquakeX	262.0
My(N·m)		
Maximum bending	maxMx (long period)	7500.0
moment(N·m)	(short period)	7563.0
	maxMy (short period wind)	1434.2
	(short period earthquak	262.0
Second section moment	77 120 1000	563.623
	Iy(cm4)	173.23
Section factor	Zx(cm3)	75.15
	Zy(cm3)	36.47
Max. bending stress deg.		6.99
$\sigma_{\rm X}({\rm N/mm2})$	Short period load	76.90
	Short period blowing up(vertical)	56.47
	Short period blowing down(vertical)	-75.47
	Short period earthquake(vertical)	6.99
	Short period blowing up(vertical)+WindY	81.64
	Short period blowing down(vertical)+WindY	-100.64
	Short period earthquake(vertical) + Earthquak	10.48
max σ x (N/mm2)	Long period	6.99
(uniaxial bending)	Short period(Y direction Vertical load)	100.64
Bending stress degree	Short period windX	39.33
σy(N/mm2)	Short period earthquakeX	7.18



#### 6-2 Post permissible stress degree

Permissible pressure stress degree

	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
cλ≦cλp	F/ν	Long period x 1.5
<b>cλp<cλ≦cλe< b=""></cλ≦cλe<></b>	$(1.0-0.5((c\lambda-c\lambda p)/(c\lambda e-c\lambda p)))F/\nu$	Long period x 1.5
cλe <cλ< td=""><td><math>(1/c\lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></cλ<>	$(1/c\lambda^2) \cdot (F/\nu)$	Long period x 1.5



#### 1) Frange plate of beam <top/bottom face>

$$\Gamma d := d/t \cdot \sqrt{(F/E)}$$

Γd= 1.06

- a) Γd ≦ 1.34
- fb = F/1.5
- b)  $1.34 < \Gamma d \le 2.69$
- $fb = F 0.248F \Gamma d$
- c)  $2.69 < \Gamma d$
- fb =  $2.41 \text{ F/}(\Gamma d^2)$

120.0 N/mm<sup>2</sup> fc=

#### 2) Web plate of beam (side face)

 $\Gamma d := d/t \cdot \sqrt{(F/E)}$ 

Γd= 4.48

- a) Γd ≦ 1.34
- fb = F/1.5
- b)  $1.34 < \Gamma d \le 2.69$
- $fb = F 0.248F \Gamma d$
- c)  $2.69 < \Gamma d$
- fb = 2.41 F/( $\Gamma d^2$ )

fc=

Therefore, result date is			
	fc=	21.7 N/mm <sup>2</sup>	
	fc=	32.5 N/mm <sup>2</sup>	

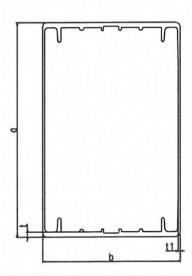
21.7 N/mm<sup>2</sup>

#### 6-3 Permissible stress degree at bend parts

Permissible bending stress degree

Permissible bending stress degree		
	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
ьλ≦ьλр	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	15.00	cm
t=	0.44	cm
t1=	0.16	cm
b=	9.50	cm
Young's modulus factor E=	70000	N/mm <sup>2</sup>
Shear elasticity factor of bending material G=	27000	Nmm
Torsion fixed number of bending material=	329.6	cm <sup>4</sup>
Second section moment around weak axis Iy=	173.233	cm <sup>4</sup>
Section factor of bending direction Z=	75.15	cm <sup>3</sup>
F: Standard strength(N/mm2) =	180	N/mm <sup>2</sup>
$b \lambda = \sqrt{My/Me}$	0.28	
$Me=C\sqrt{((\pi^2EIyGJ)/lb^2)}=$	170876462	Nmm
Bending moment My=	13527000	Nmm
$C=1.75+1.05(M2/M1)+0.3(M2/M1)^2=$	1	
M2=	-5671.6	Nm
M1=	5671.6	Nm
M2/M1=	-1	
lb=	1909.8	mm
$b \lambda p = 0.6 + 0.3 (M2/M1) =$	0.3	



1.41  $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

> 1.53 ыλ≦ыλр

117.9 N/mm<sup>2</sup> Permissble stress degree fb:  $F/\nu =$ 

bλ e=1/√0.5=

#### Permissible bending stress degree (strong axis) 1) Frange plate <top/bottom face> $\Gamma$ b : The conversion ratio = b/t · $\sqrt{(F/E)}$ $\Gamma b =$ 1.06 a) Γb ≤ 1.34 fc = F/1.5b) $1.34 < \Gamma b \le 2.69$ $fc = F - 0.248F \Gamma b$ c) 2.69 < \Gamma b $fc = 2.41 F/(\Gamma b2)$ 120.0 N/mm<sup>2</sup> 2) Web plate (side face) $\Gamma d$ : The conversion ratio = $d/t \cdot \sqrt{(F/E)}$ $\Gamma d =$ 4.48 a) Γd ≤ 3.29 fb = F/1.5b) $3.29 < \Gamma d \le 6.57$ $fb = F - 0.101F \Gamma d$ fb = 14.4 F/( $\Gamma d^2$ ) c) $6.57 < \Gamma d$ 98.6 N/mm<sup>2</sup> Therefore, result date is \*\*\* 98.6 N/mm<sup>2</sup> fbx= 148.0 N/mm<sup>2</sup> Permissible bending stress degree (weak axis) 1) Frange plate <top/bottom face> $\Gamma$ b : The conversion ratio = b/t • $\sqrt{(F/E)}$ Гb= 4.48 a) Γb ≦ 1.34 fc = F/1.5 b) $1.34 < \Gamma b \le 2.69$ fc = F - 0.248F □ d c) 2.69 < \Gamma b fc = 2.41 F/( $\Gamma d2$ ) fb= 21.7 N/mm<sup>2</sup> 2) Web plate <side face> $\Gamma d$ : The conversion ratio = $d/t \cdot \sqrt{(F/E)}$ Γd= 1.06 a) Γd ≦ 3.29 fb =F/1.5 b) $3.29 < \Gamma d \le 6.57$ fb =F - 0.101F \( \text{d} \) c) 6.57 < $\Gamma d$ fb =14.4 F/( $\Gamma d^2$ ) 120.0 N/mm<sup>2</sup> fb= Therefore, result date is ... fby= 21.7 N/mm<sup>2</sup> fby= 32.5 N/mm<sup>2</sup> Examination of the section of the post Short period snow load $\sigma b =$ 76.9 N/mm<sup>2</sup> $\sigma c=N/A=$ 3.1 N/mm<sup>2</sup> $\sigma b/fb + \sigma c/fc =$ 0.62 < 1.0 OK! Wind blow down σb= 81.6 N/mm<sup>2</sup> $\sigma c=N/A=$ 2.3 N/mm<sup>2</sup> $\sigma b/fb + \sigma c/fc =$ 0.62 < 1.0OK! Wind blow up 100.6 N/mm<sup>2</sup> σb= $\sigma t=N/A=$ 3.0 N/mm<sup>2</sup> 0.70 < 1.0 $\sigma b/fb + \sigma t/ft =$ OK!

115.6 < 140

OK !

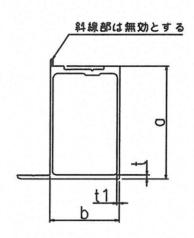
2 · lk/i=

#### 7. Main Frame Bending permissible stress degree

7-1 Bending permissible stress degree

	Permissible stress degree for long period (N∕mm2)	Permissible stress for short period(N/m3)
bλ≦bλp	F/ <i>ν</i>	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	4.60 cm	-
t=	0.11 cm	
t1=	0.09 cm	
b=	2.50 cm	
Young's modulus factor E=	70000 N/mm <sup>2</sup>	
Shear elasticity factor of bending materialG=	27000 Nmm	
Torsion fixed number of bending material=	3.3 cm <sup>4</sup>	
Second section moment around weak axis Iy=	2.126 cm <sup>4</sup>	
Section factor of bending direction Z=	2.512 cm <sup>3</sup>	
F: Standard strength $(N/mm2) =$	180 N/mm <sup>2</sup>	
b $\lambda = \sqrt{(My/Me)}$	0.28	
Me=C√(( $\pi$ 2EIyGJ)/lb2)=	5684039 Nmm	
Bending moment My=	452160 Nmm	
C=	1.13	
lb=	715 mm	
$b \lambda p = 0.6 + 0.3 (M2/M1) =$	0.3	
b λ e=1/√0.5=	1.41	



 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

 $\nu =$ 1.53 Ьλ≦Ьλр

> 117.9 N/mm<sup>2</sup> fb=

> > 0.41

1.07

120.0 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

#### 1) Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t ·  $\sqrt{(F/E)}$ 

Гь =

fb = F/1.5

a) Γb ≤ 0.438 b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c) 0.876 < Fb

fb =  $0.256 \text{ F/}(\Gamma \text{b}^2)$ 

 $\Gamma$ b : The conversion ratio = b/t ·  $\sqrt{(F/E)}$ 

fb=

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

 $fc = 2.41 \, F/(\Gamma \, d2)$ 

c) 2.69 <  $\Gamma$ b

120.0 N/mm<sup>2</sup> fb=

#### 2) Wave plate of beam (side face)

 $\Gamma$ b : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

2.47

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c) 6.57 < \Gamma\d

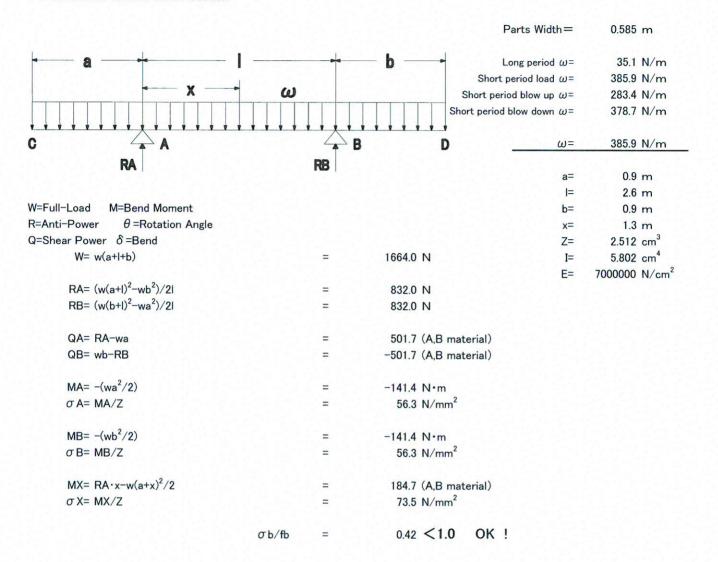
fb =  $14.4 \text{ F}/(\Gamma d^2)$ 

120.0 N/mm<sup>2</sup> fb=

Therefore, result data is...

fb= 117.9 N/mm<sup>2</sup> 176.9 N/mm<sup>2</sup> fb=

#### 7-2 Calculation of Main Frame Section

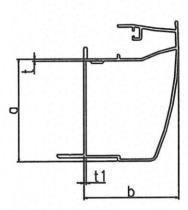


#### 8. Front frame bending permissible stress degree

8-1 Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
ьλ≦ьλр	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td>(1/b λ<sup>2</sup>)·(F/ν)</td><td>Long period x 1.5</td></bλ<>	(1/b λ <sup>2</sup> )·(F/ν)	Long period x 1.5

a=	4.77	cm	
t=	0.10	cm	
t1=	0.10	cm	
b=	4.20	cm	
Young's modulus factor E=	70000	N/mm <sup>2</sup>	
Shear elasticity factor of bending materialG=	27000	Nmm(アルミ材)	
Torsion fixed number of bending material=	8.4	cm <sup>4</sup>	
Second section moment around weak axis Iy=	6.911	cm <sup>4</sup>	
Section factor of bending direction Z=	3.805	cm <sup>3</sup>	
F:Standard strength(N/mm2) =	132	N/mm <sup>2</sup>	
b $\lambda = \sqrt{(My/Me)}$	0.17		
Me=C√(( π 2EIyGJ)/lb2)=	16407392	Nmm	
Bending moment My=	502260	Nmm	
C=	1.13		
lb=	715	mm	
$b \lambda p = 0.6 + 0.3 (M2/M1) =$	0.3		



b  $\lambda$  e=1/ $\sqrt{0.5}$ = 1.41

 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

ν= 1.51

ьλ≦ьλр

87.4 N/mm<sup>2</sup> fb=

#### Permissible stress degree at bend parts

#### 1) Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

Гь= 1.74

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c) 2.69 <  $\Gamma$ b

 $fc = 2.41 F/(\Gamma d2)$ 

75.1 N/mm<sup>2</sup> fb=

#### 2) Web plate of beam <side face>

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

Γd= 1.98

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

 $fb = 14.4 F/(\Gamma d^2)$ 

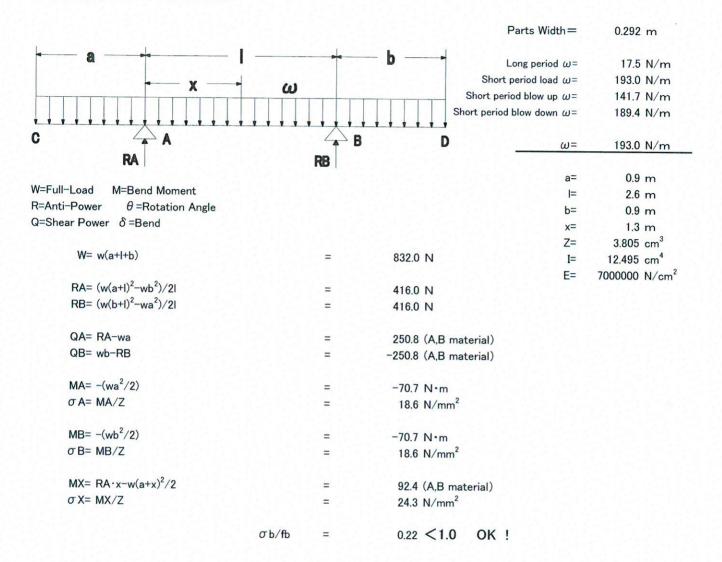
fb=

Therefore, result data is...

75.1 N/mm<sup>2</sup> fb= 112.7 N/mm<sup>2</sup> fb=

88.0 N/mm<sup>2</sup>

#### 8-2 Calculation of Front Frame Section



#### 9. Bending permissible stress degree at rear frame

#### 9-1 Calculation method of effective section

 $\Gamma b = b/t \cdot \sqrt{(F/E)} = 0.438$  $b/t = 0.438/\sqrt{(F/E)} = 10.09$  Therefore...

Effective Depth

t2=

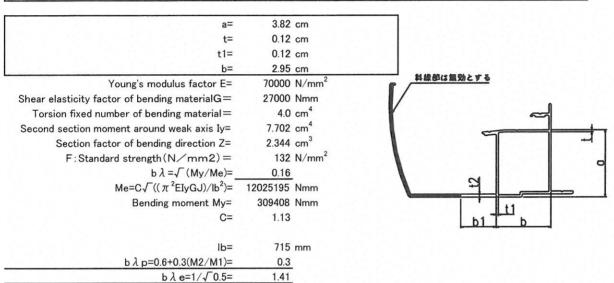
b1= 17.15 mm

#### 9-2. Bending permissible stress degree at rear frame

Rending nermissible stress degree

bending permissible stress degre		
	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
bλ≦bλp	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td>(1/b λ<sup>2</sup>) • (F/ν)</td><td>Long period x 1.5</td></bλ<>	(1/b λ <sup>2</sup> ) • (F/ν)	Long period x 1.5

1.70 mm



 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

 $\nu = 1.51$ 

ьλ≦ьλр

fb= 87.5 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

#### 1) Frange plate of beam <top/bottom face>

 $\Gamma\,b\,\,$ : The conversion ratio = b/t  $\cdot\,\,\sqrt{(F/E)}$ 

Γb = 0.98

a) Гb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ c)  $2.69 < \Gamma b$   $fc = F - 0.248F \Gamma d$ 

 $fc = 2.41 F/(\Gamma d2)$ 

fb= 88.0 N/mm<sup>2</sup>

#### 2) Web plate of beam <side face>

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

Γd = 1.30

a)  $\Gamma d \leq 3.29$ 

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ c)  $6.57 < \Gamma d$   $fb = F - 0.101F\Gamma$ 

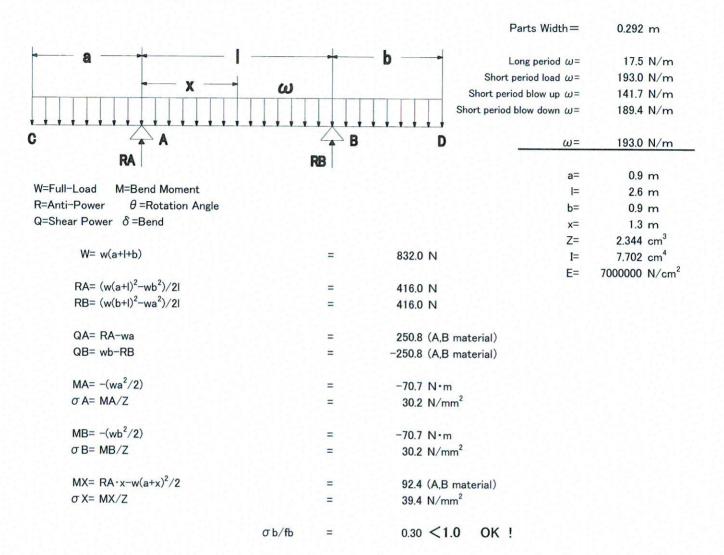
0, 0.0.

fb = 14.4 F/( $\Gamma d^2$ ) fb= 88.0 N/mm<sup>2</sup>

Therefore, result data is...

fb= 87.5 N/mm<sup>2</sup> fb= 131.2 N/mm<sup>2</sup>

#### 9-3 Calculation of Rear Frame Section



#### 10. Rafter / Roof retainer bending permissible stress degree

10-1 Bending permissible stress degree

a=	1.30 cm
t=	0.10 cm
t1=	0.17 cm
b=	0.72 cm
b1=	1.99 cm

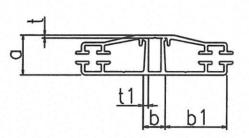
Young's modulus factor E= 70000 N/mm<sup>2</sup>

Shear elasticity factor of bending materialG= 27000 Nmm

Second section moment around weak axis Iy= 0.364 cm<sup>4</sup>

Section factor of bending direction Z= 0.529 cm<sup>3</sup>

F: Standard strength(N/mm2) = 132 N/mm<sup>2</sup>



Therefore...

 $fb = 88.0 \text{ N/mm}^2$ 

#### Permissible stress degree at bend parts

#### Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Γb = 0.86

a)  $\Gamma b \leq 0.438$  fb =

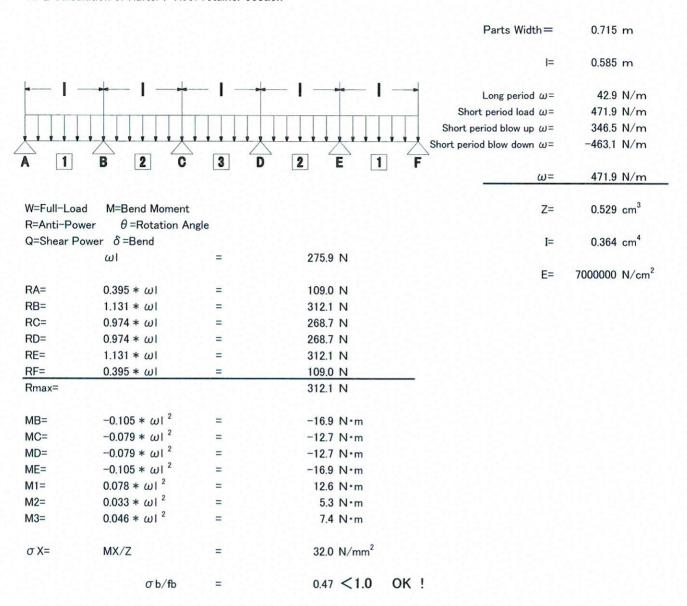
b)  $0.438 < \Gamma b \le 0.876$  fb = F -  $0.760F \Gamma b$ 

c)  $0.876 < \Gamma b$  fb =  $0.256 \text{ F/}(\Gamma b2)$  fb=  $45.3 \text{ N/mm}^2$ 

Therefore...

fb= 45.3 N/mm<sup>2</sup>

fb= 68.0 N/mm<sup>2</sup>



#### 11. Side frame bending permissible stress degree

#### 11-1 Calculation method of effective section

$$\Gamma$$
 b = b/t•  $\sqrt{(F/E)}$  = 0.438  
b/t = 0.438/ $\sqrt{(F/E)}$  = 10.09  
Effective Depth

t2=

1.20 mm

Therefore...

b2= 12.10 mm

#### 11-2 Bending permissible stress degree

1.30 cm
0.11 cm
0.17 cm
0.72 cm
1.99 cm

Young's modulus factor E=

70000 N/mm<sup>2</sup>

ear elasticity factor of bending materialG=

27000 Nmm

cond section moment around weak axis Iy=

2 cm<sup>4</sup>

Section factor of bending direction Z=

0.324 cm<sup>3</sup>

F: Standard strength (N/mm2) =

132 N/mm<sup>2</sup>

#### Therefore···

88.0 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

#### Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

Гь =

0.79

a) Γb ≤ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c) 0.876 < Гb

 $fb = 0.256 F/(\Gamma b2)$ 

Therefore···

fb=

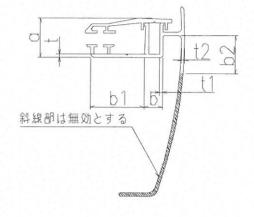
fb=

53.2 N/mm<sup>2</sup>

53.2 N/mm<sup>2</sup>

fb=

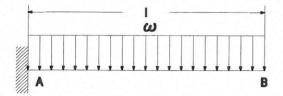
79.8 N/mm<sup>2</sup>



				Parts Width=	0.363 m
				=	0.585 m
- 1 -	+ I -+	-1-	+ I -+ I	Long period $\omega$ =	21.8 N/m
				Short period load ω=	239.6 N/m
				Short period blow up $\omega$ =	175.9 N/m
		4 4 4 4	D 2 E 1	Short period blow down $\omega$ =	-235.1 N/m
A 1	B 2 C	3	D 2 E 1	<b>F</b> ω=	239.6 N/m
W=Full-Loa				Z=	0.324 cm <sup>3</sup>
R=Anti-Pov		gle			4
Q=Shear P	ower δ=Bend			I=	0.399 cm <sup>4</sup>
	ωΙ	=	140.1 N	E=	7000000 N/cm <sup>2</sup>
RA=	0.395 * ωI		55.3 N		7000000 TV/ CITI
RB=	1.131 * ωΙ	11=111	158.4 N		
RC=	0.974 * WI	=	136.4 N		
RD=	0.974 * ωI	=	136.4 N		
RE=	1.131 * ωΙ	=	158.4 N		
RF=	$0.395 * \omega 1$	= '	55.3 N		
Rmax=			158.4 N		
MB=	$-0.105 * \omega 1^{2}$		-8.6 N•m		
MC=	$-0.079 * \omega 1^{2}$	_	-6.5 N⋅m		
MD=	$-0.079 * \omega 1^{2}$		-6.5 N•m		
ME=	$-0.105 * \omega 1^{2}$	=	-8.6 N⋅m		
M1=	$0.078 * \omega 1^{2}$	=	6.4 N·m		
M2=	$0.033 * \omega 1^{2}$	= -	2.7 N·m		
M3=	0.046 * ωl <sup>2</sup>	=	3.8 N·m		
σ X=	MX/Z	=	26.5 N/mm <sup>2</sup>		
	σb/fb		0.33 < 1.0	OK!	

#### 12. Corner bracket examination

#### 12-1 Beam load



#### Load chart

Туре		The state of the s	
Vertical load width (m)	Total/post o	juantity	2.156
I (m)	D-d1-d2		2.925
Load	Long period	Long period load	
ω(N/m)	Short period	load	1423.0
	Short period blowing	ng up(vertical)	1044.9
	Short period blowing	ng up(vertical)	-1267.2
	Short period blowing	ng down(horizontal)	160.5
	Short period earth	quake(vertical)	129.4
	Short period earth	quake(horizontal)	38.8
	Long period	load	553.4
	Short period	load	6087.2
Bending moment	Short period blowing	ng down(vertical)	4469.8
M(N·m)	Short period blowing	ng up(vertical)	-5420.7
	Short period blowing (horizontal)		686.6
	Short period eartho	quake(vertical)	553.4
	Short period eartho	quake(horizontal)	166.0
Maximum bending momen	maxMx	(long period)	
(N·m)	25.41357	(short period)	6087.2
	maxMy	(long period)	
		(short period)	686.6
Second section moment	Ix(cm <sup>4</sup> )		231.7
	Iy(cm <sup>4</sup> )		60.7
Section factor	Zx(cm <sup>3</sup> )	90-91 (20 <u>92 )</u>	37.4
	Zy(cm <sup>3</sup> )		18.1
Elasticity factor	E(N/cm <sup>2</sup> )		21000000
Maximum bending stress degree	max σ x		162.9
(N/mm2)	max σ y		37.9
Vertical maximum deformation quantity	max δ x	(cm)	2.68
	max δ x/I	1/	161
Flat maximum deformation quantity	max δ y	(cm)	1.15
	max δ y ∕ I	1/	375

#### 12-2 Calculation of Corner bracket Section

Material	Second section moment Section  Ix(cm4) Iy(cm4) Zx(cm3)		Second section moment Section factor			factor
Material			Zx(cm3)	Zy(cm3)		
GB8064	205.211	65.073	28.119	20.335		

fb= 420 N/mm<sup>2</sup> Mx= 6087.2 N·m My= 686.6 N·m

 $\sigma bx = 216.5 \text{ N/mm}^2$  $\sigma by = 33.8 \text{ N/mm}^2$ 

 $\begin{array}{lll} \sigma \, \text{bx/fb=} & 0.52 \, < \! 1.0 & \text{OK !} \\ \sigma \, \text{by/fb=} & 0.08 \, < \! 1.0 & \text{OK !} \\ \end{array}$ 

#### 13. Examination of main frame connecting part

#### 13-1 Calculation of Load

· Anti-Power of rafter



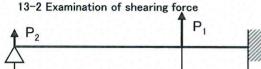
P1=

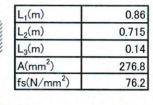
←from "Calculation of rafter"

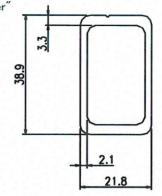
·Anti-Power of connecting rafter

P2=

←(Anti-Power of rafter)/2







$$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_3$$

168.0 N

312.1 N

156.0 N

$$\tau = Q/A =$$

0.61 N/mm<sup>2</sup>

0.01 < 1.0

OK!

OK!

#### 14. Examination of front frame connecting part

#### 14-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

P1=

109.0 N

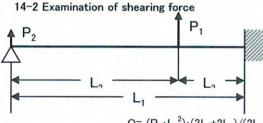
←from "Calculation of rafter"



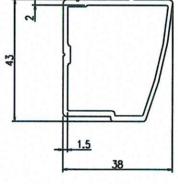
P2=

54.5 N

←(Anti-Power of rafter)/2







- $Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + U_3$ 
  - Q=

58.7 N

 $\tau = Q/A =$ 

0.22 N/mm<sup>2</sup>

τ/fs=

0.01 < 1.0

#### 15. Examination of gutter connecting part

#### 15-1 Calculation of Load

$$P_1 =$$

P1=

109.0 N

←from "Calculation of rafter"

·Anti-Power of connecting rafter

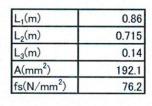
Po=

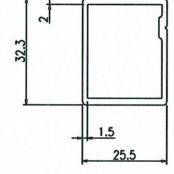
P2=

54.5 N

←(Anti-Power of rafter)/2

# 15-2 Examination of shearing force





$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2$
--

Q=

58.7 N

 $\tau = Q/A =$ 

0.31 N/mm<sup>2</sup> 0.01 < 1.0

T /fs=

OK!

#### 16. Examination of main frame and beam connection

#### 16-1 Examination of screw pull-out force

·Pull-out force/screw

T= 416.0 N

Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $172.7 \text{ N/mm}^2$ 

• Effective section

11.2 mm<sup>2</sup> A= σt= 37.1 N/mm<sup>2</sup>

0.21 < 1.0 OK!  $\sigma t/ft=$ 

β	0.6
Screw diameter	5
Core diameter	3.78
Pitch	0.8
t(Thickness)	4.6
Ft(Standard strength)	100

#### 16-2 Examination of Beam bending stress

·Beam top face bending moment

M= 2334.0 N·mm 58.6 mm<sup>3</sup> Z= 39.9 N/mm<sup>2</sup> σb=

 $\sigma b/fb=$ 

0.19 < 1.0OK!

#### b (Beam depth dimension) t(Thickness) 2.4 a (load point) 18.5

#### 17. Examination of rafter and main frame connection

#### 17-1 Examination of screw pull-out force

·Pull-out force/screw

T= 312.1 N

Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $93.7 \text{ N/mm}^2$ 

· Effective section

6.7 mm<sup>2</sup> A= 46.3 N/mm<sup>2</sup> σt= 0.49 < 1.0OK!  $\sigma t/ft=$ 

0.6 Screw diameter 2.93 Core diameter Pitch 0.7 t(Thickness) 2.1 Ft (Standard strength)

#### 17-2 Examination of Main frame bending stress

· Main frame top face bending moment

M= 898.7 N·mm Z= 22.0 mm<sup>3</sup> 40.8 N/mm<sup>2</sup>  $\sigma b =$ 

0.20 < 1.0  $\sigma b/fb=$ OK!

b (Beam depth dimension)	25
t(Thickness)center	2.3
a (load point)	10

#### 18. Examination of Roof material

#### 18-1 Examination of Bending volume

Poisson ratio : $\nu =$	0.3	Bending volume: Wmax
Distribution Load : P=	0.0116 kgf/cm <sup>2</sup>	A • Wmax <sup>3</sup> +B • Wmax+C=0
E:Young's modulus factor =	21000 kgf/cm <sup>2</sup>	
Thickness:h=	0.18 cm	$A = (4 \nu / a^2 b^2 + (3 - \nu^2) \cdot (1/a^4 + 1/b^4))/h^3$
Short edge a=	70.3 cm	= 2096.9
Long edge b=	296.2 cm	$B= (4/3) \cdot (1/a^2 + 1/b^2)^2 / h$
		= 33.8
		$C = -256(1 - \nu^2)P/(\pi^6Eh^4)$
		= -12701.0

Bending volume : Wmax=

1.82 cm

#### 18-2 Bending stress degree

$$\max \sigma x = \frac{((\pi^2 \cdot E \cdot W_{max})/(8 \cdot (1 - \nu^2))) \cdot ((2 - \nu^2) W_{max} + 4h)/a^{2+} (\nu (W_{max} + 4h))/b2)}{44.4 \text{ kgf/cm}^2} = \frac{44.4 \text{ kgf/cm}^2}{44.4 \text{ kgf/cm}^2} < \frac{551}{44.4 \text{ kgf/cm}^2} \cdot \frac{6 \cdot W_{max} + 4h}{44.4 \text{ kgf/cm}^2} \cdot \frac{6 \cdot W_{max} + 4h}{44.4 \text{ kgf/cm}^2} = \frac{44.4 \text{ kgf/cm}^2}{44.4 \text{ kgf/cm}^2} < \frac{44.4 \text{ kgf/cm}^2}{44.4 \text{ kgf/cm}^2} \cdot \frac{6 \cdot W_{max} + 4h}{44.4 \text{ kgf/cm}^2} = \frac{44.4 \text{ kgf/cm}^2}{44.4 \text{ kgf/cm}^2} \cdot \frac{6 \cdot W_{max} + 4h}{44.4 \text{ kgf/cm}^2} \cdot \frac{6 \cdot W_{max} + 4h}{44.4 \text{ kgf/cm}^2} = \frac{44.4 \text{ kgf/cm}^2}{44.4 \text{ kgf/cm}^2} \cdot \frac{6 \cdot W_{max} + 4h}{44.4 \text{ kgf/cm}^2}$$

#### 18-3 Necessary depth of insert

Necessary depth of insert  $\Delta L$ 

 $\Delta L = \Delta X \times SF + \Delta I$ 

However,  $\Delta X$ : The gap volume by a bend

= (lx - b)/2

Ix: Arc length while bending

 $= 2 \times \sin(-1(b/2)/r) \times r$ 

r: Radius rate while bending

 $= (b2+4\delta 2)/8\delta$ 

 $\delta$ : Bending rate of Polycarbonate = Wmax (cm)

b: Length of short (cm)

 $\Delta I$ : The volume of expansion and contraction at temperature

 $= K \cdot \Delta t \cdot b/2$ 

K : Line coefficient of expansion (cm/cm/°C)

∆t : Temperature differency at 50°C

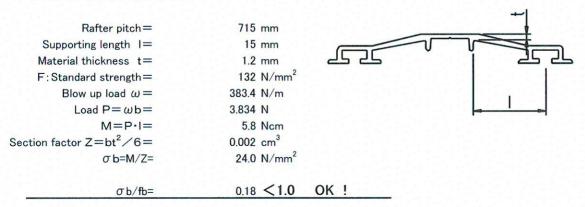
SF: Safety ratio SF=3. 0

r=	340.4	
Ix=	70.43	cm
∆ X=	0.06	cm
K=	0.00007	$cm/cm/^{\circ}C$
∆t =	50	°C
SF=	3.0	
∆ I=	0.12	cm

Therefore...

Δ L= 0.31 cm depth or more < 1.89 cm ∴ OK!

#### 19. Examination of Roof retainer



# 20. Ground Foundation

Resistance moment  $M_{R^{=}}(N+W)\times e+q's\times b\times h_{1}\times (h_{1}+h_{0})$ 20-1 Without concrete floor

Σœ

h/2

- h

Resistance moment  $M=M'+Q*(h/2)-N \times (d/2-a)$ 

Base Foundation Lateral Pressure

ay= ax= 급 무 무

0.90 m 1.20 m 0.55 m 0.30 m 0.45 m 100 KN/m<sup>2</sup> 200 KN/m<sup>3</sup> Short Term Permissible Endurance strength of ground q= No line concrete Volume weight Endurance strength of ground Fe=

		ay
;	×	
	a p	

P0

×

h1

	Spindle Force(N)	Shear power(N)	ver(N)	Moment	t(Nm)		Foundation size(m)	size(m)		Base Weight	Endurance strength of ground	Lateral Pressure
	Z	ĕ	ģ	M,×	M,y	q	Q	4	В	W(N)	q'(kN/m2)	's(kN/m2)=0.5c
Long period load	470.8	0.0	0.0	525.4	0.0	06.0	1.20	0.55	0.30	13,365	100	50.0
Short period load	4351.6	0.0	0.0	5779.0	0.0	06.0	1.20	0.55	0.30	13,365	200	
Short term earthquake X	470.8	116.4	0.0	525.4	262.0	06.0	1.20	0.55	0.30	13,365	200	
Short term earthquake Y	470.8	0.0	116.4	787.3	0.0	06.0	1.20	0.55	0.30	13,365	200	
Short period blow down + Holizontal	3217.4	637.4	0.0	4243.5	1434.2	06.0	1.20	0.55	0.30	13,365	200	
Short period blow down + Holizontal	3217.4	0.0	840.6	6134.9	0.0	06.0	1.20	0.55	0.30	13,365		
Short period blow up+Holizontal X	-4106.8	637.4	0.0	-5671.6	1434.2	06.0	1.20	0.55	0.30	13,365	200	100.0
Short period blow up+Holizontal Y	-4106.8	0.0	-840.6	-7563.0	0.0	06.0	1.20	0.55	0.30	13,365	200	

subsidence load		Endurance strength of ground
(N) M+N	\	$p \times d \times q$ (N)
17717	/	216000 OK!

216000 OK!	IExamination of uplift (short period blow up)	Base weight	$b \times d \times h \times \gamma(N)$	13365 OK!
/	of		1	/
11771	<b>■</b> Examination	uplift load	(N) N	4107

				X direction	on				
	t(m)	e(m)	h0(m)	h1(m)	Resistance MRx	Fall Mx		ann	JUDGMENT
	$(N+W)/(b \times d)$	(d-t)/2	Qy/(b×q's)	(h-h0)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	Z	MR≧M
Long period load	0.154	0.523	0.000	0.275	10,641	384.1	0.036		ş
Short period load	860.0	0.551	0.000	0.275	16,564	4473.5	0.270	V1.0	ð
Short term earthquake X	7200	0.562	0000	0.275	14,576	384.1	0.026		ò
Short term earthquake Y	0.077	0.562	0.001	0.274	14,576	678.1	0.047		ð
Short period blow down + Holizontal X	0.092	0.554	0.000	0.275	15,992	3278.3	0.205	V 1.0	ð
Short period blow down + Holizontal Y	0.092	0.554	0.009	0.270	15,990	5400.8	0.338		Š
Short period blow up+Holizontal X	0.051	0.574	0.000	0.275	12,123	-4439.6	0.366		9 S
Short period blow up+Holizontal Y	0.051	0.574	600'0	0.270	12,121	-6562.1	0.541		

				Y direction	on				
	t(m)	e(m)	h0(m)	h1(m)	Resistance MRx	Fall Mx		JUDGI	UDGMENT
	$(h+M)/(d\times d)$	(b-t)/2	Qx/(d x q's)	(h-h0)/2	MRy(N·m)	My(N·m)	My/Mry	MR	MR≧M
Short term earthquake X	0.058	0.421	0.001	0.275	14,902	294.0	0.020	<1.0	Š
Short period blow down + Holizontal X	690'0	0.415	0.005	0.272	15,963	1609.5	0.101	0.101 < 1.0	ð
Short period blow up+Holizontal X	0.039	0.431	0.005	0.272	13,062	1609.5	0.123	<ul><li>1.0</li></ul>	ð



Base Foundation	Lateral Pressure 0.5	b= 0.60 m	d= 0.45 m	h= 0.55 m	h <sub>1</sub> = 0.45 m	l= 0.35 m	Concrete floor thickness t= 0.10 m	Endurance strength of ground Fe= 50 KN/	
(h/2)							Concrete f	Endurance streng	

0.60 m	0.45 m	0.55 m	0.45 m	0.35 m	0.10 m	50 KN/m <sup>2</sup>	100 KN/m <sup>2</sup>	22.5 KN/m <sup>3</sup>	15000 KN/m <sup>3</sup>
=q	<b>=</b> 0	≒d	=lq	Ш.	Concrete floor thickness t=	Endurance strength of ground Fe=	Short Term Permissible Endurance strength of ground q=	No line concrete Volume weight $\gamma$ =	Concrete standard strength Fc=

t: 土間 ブラケ:			
₩₩	M	b b	0
		, p	
	h h1	(人断面)	

	V V V		(国本)
X X		X	р
	A P		: 縁端距離

	Spindle Force(N)	Shear power(N)	ver(N)	Moment(Nm)	(MM):		Foul	Foundation size(m)	0		Base Weight	Endurance strength of ground	Lateral Pressure
	z	Q×	Qy	M,×	M, y	q	Ф	h h	nd part lengtoor thicknes	thicknes	W(N)	q'(kN/m2)	i's(kN/m2)=0.5c
Long period load	470.8	0.0	0.0	525.4	0.0	09'0	0.45	0.55	0.35	0.10	3,341	20	25.0
Short period load	4351.6	0.0	0.0	5779.0	0.0	09'0	0.45	0.55	0.35	0.10	3,341	100	50.0
Short term earthquake X	470.8	116.4	0.0	525.4	262.0	09'0	0.45	0.55	0.35	0.10	3,341	100	50.0
Short term earthquake Y	470.8	0.0	116.4	787.3	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	50.0
Short period blow down + Holizontal >	3217.4	637.4	0.0	4243.5	1434.2	09.0	0.45	0.55	0.35	0.10	3,341	100	50.0
Short period blow down + Holizontal \	3217.4	0.0	840.6	6134.9	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	50.0
Short period blow up+Holizontal X	-4106.8	637.4	0.0	-5671.6	1434.2	09.0	0.45	0.55	0.35	0.10	3,341	100	50.0
Short period blow up+Holizontal Y	-4106.8	0.0	-840.6	-7563.0	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	50.0

amination of subsidence (short period snow)	dence load Endurance strength of ground	$(N) \sim b \times d \times d (N) W$	7693 27000 OK!
Ex	subsid	ż	

n wind blow up)			94500 OK!
Concrete floor panchingshere (short term wind blow up)	permissible share force	$1.5 \times f_S \times t \times 0.91 \times 2(N)$	945
or		1	/
■Concrete flo	share force	(N) Ø	57563

Concrete floor bearing capacity (short term wind blow up)	apacity	75t/2(N)	262500 OK!
bearing capacity	bearing capaci	fc × b × 0.875t	
or		1	/
■Concrete flo	share force	(N)	57563

				X direction					
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		JUDGMENT	MENT	
	N+W(N)	$(N+W)/(b \times q^2)$	(d-t)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MR	MRIN	
Long period load	3812.1	0.127	0.161	2,134	131.3	0.062	<1.0	Š	
Short period load	7692.9	0.128	0.161	4,275	1444.7	0.338	<1.0	ð	
Short term earthquake X	3812.1	0.064	0.193	3,774	131.3	0.035	<1.0	ð	
Short term earthquake Y	3812.1	0.064	0.193	3,774	199.7	0.053	V1.0	S	
Short period blow down + Holizontal X	6558.7		0.170	4,155	1060.9	0.255	<1.0	송	
Short period blow down + Holizontal Y	6558.7	0.109	0.170	4,155	1554.7	0.374	V1.0	ð	
Short period blow up+Holizontal X	0.0	0.000	0.225	3,038	-1417.9	0.467	V1.0	ð	
Short period blow up+Holizontal Y	0.0	0.000	0.225	3,038	-1911.8	0.629	<1.0	OK	

The second secon				Y direction				
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		JUDG	JUDGMENT
	N+W(N)	$(N+W)/(b \times q')$	(d-t)/2	MRx(N·m)	Mx(N-m)	Mx/MRx	MR	MR≧M
Short term earthquake X	3812.1	0.085	0.258	3,260	68.4	0.021	0.021 < 1.0	OK :
Short period blow down + Holizontal X	6558.7	0.146	0.227		374.5	0.099	<1.0	OK-
Short period blow up+Holizontal X	0.0	0.000	0.300	2,278	374.5	0.164	<1.0	OK-

#### STATIC REPORT

PJR-series

4333-H23

#### 1. Material and Evaluation

#### (1)Post

Materi A6063S-T6(SS)

Material performance

Colum

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8387	12.15	475.04	161.02	63.34	33.90	70000	3.64	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb + \sigma c/fc =$ 

0.62 < 1.0 OK!

Wind blow down

 $\sigma b/fb + \sigma c/fc =$ 

0.61 < 1.0 OK!

Wind blow up

 $\sigma b/fb + \sigma t/ft =$ 

0.69 < 1.0 OK!

2 · lk/i=

112.0 < 140 OK!

#### 2Beam

Materi A6063S-T6(SS)

Material performance

Bean

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	ly(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8392	7.75	187.39	53.85	30.22	16.07	70000	2.64	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb=$ 

0.77 < 1.0 OK!

Wind blow down

 $\sigma bx/fbx=$ 

0.57 < 1.0 OK!

Wind blow up

 $\sigma$ bx/fbx=

0.76 < 1.0 OK!

#### 3 Main frame

Materi A6063S-T6(SS)

Material performance

loch

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8578有	1.64	5.33	2.07	2.27	0.91	70000	1.13	

Material evaluation

 $\sigma b/fb=$ 

0.39 < 1.0 OK!

#### 4)Front frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	on moment	Section	factor	Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8401	2.55	12.50	6.91	3.81	2.20	70000	1.65	132

Material evaluation

 $\sigma b/fb=$ 

0.18 < 1.0 OK!

#### **5**Rear frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8404有	2.55	7.70	5.90	2.34	1.82	70000	1.52	132

Material evaluation

 $\sigma b/fb=$ 

0.25 < 1.0 OK!

# **6**Rafter

Materi A6063S-T5

Material performance

		Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8654+DE8666	1.88	0.36	3.75	0.53	1.48	70000	1.41	132

Material evaluation

 $\sigma b/fb=$ 

0.57 < 1.0 OK!

7Side frame

Materi A6063S-T5

Material performance

iai periormano								
	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8683+DE8412	4.05	0.40	2.00	0.32	0.93	70000	1.10	132

Material evaluation

 $\sigma b/fb=$ 

0.40 < 1.0 OK!

**®**Corner bracket

Materi SPFH590

Material performance

	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8064	8.58	205.21	65.07	28.12	20.34	210000	2.75	420

Material evaluation (without support and side panel Vex=38m/s)

 $\sigma$ bx/fb=

0.44 < 1.0 OK!

 $\sigma$  by/fb=

0.10 < 1.0 OK!

#### 9 Main frame connecting parts

Materi A6063S-T5

Material performance

اً "	i portormano	1	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
ı	GB8086	2.77	5.59	1.85	2.87	1.69	70000	0.82	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

# **®**Front frame connecting parts

Materi A6063S-T5

Material performance

10	al periormanic	, ,							
	1910	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
1	GB8084	2.62	6.94	4.75	2.95	2.26	70000	1.35	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

# 11)Rear frame connecting parts

Materi A6063S-T5

Material performance

14	ial performance								
	200 10112	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
١	Material	(cm2)	Ix(cm4)	Iv(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
ŀ	GB8085	1 92	2.92	1.83	1.78	1.40	70000	0.98	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

12 Roof material

Materi

polycarbonate

 $\max \sigma x =$ 

Material performance

	Material	Thickness	Length(short part)	Length(long part)	Inserting	Poisson ratio	Elasticity factor	F value
		cm	cm	cm	cm	ν	kgf/cm2	kgf/cm2
l	GB4107	0.18	70.3	326.4	1.89	0.3	21000	551

Material evaluation

Bending volume : Wmax=

1.82 cm

44.50 kgf/cm<sup>2</sup>

551.0 kgf/cm<sup>2</sup>

∴ok !

Necessary depth of insert AL

0.31 cm depth or more

1.89 cm

∴ok!

<sup>®</sup>Roof retainer

Materi A6063S-T5

Material performance

Material Cross		tion area Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
(	cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8411	0.79	0.03	1.84	0.08	0.72	70000		

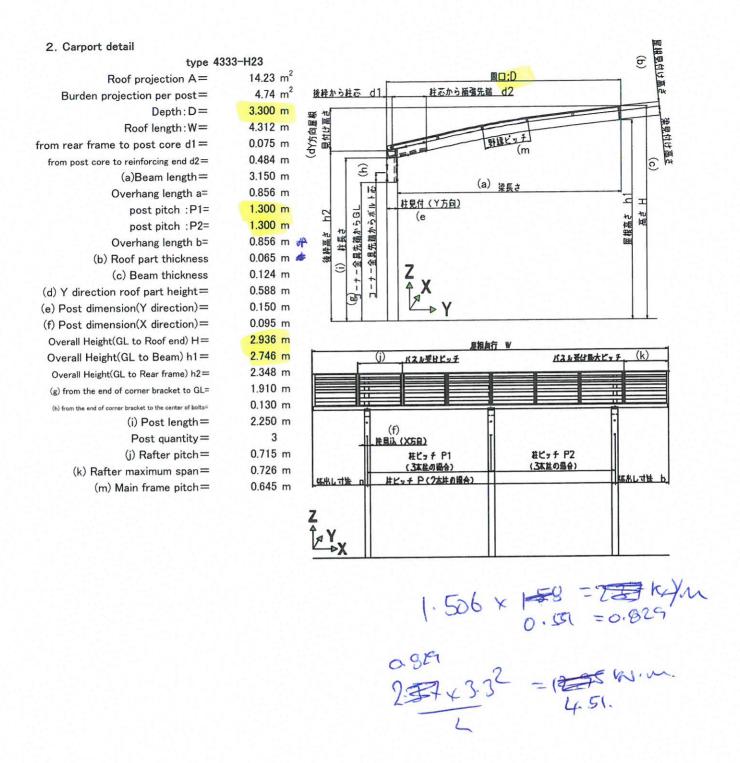
<

<

Material evaluation

 $\sigma b/fb=$ 

0.18 < 1.0 OK!



423 Win

# 3. Load design

①Vertical over load (G)

Part Weight

Roof	60.0 N/m <sup>2</sup>
Post	32.1 N/m

2Snow over load

Post quantity	Snow area	Snow quantity	Unit weight	Short period snow period
2 posts type	General area	20 cm	30 N/m²/cm	600 N/m <sup>2</sup>

# ③ Wind blowing load(Vex=38m/s)

·For design of structure frame

Speed pressureq=0.  $6E(Vex*y)^2$ = 708 N/m<sup>2</sup> Standard wind speedVex= 38 m/s E=Er2Gf= 1.194 Er=1.  $7(Zb/Z_G)^{\alpha}$ = 0.691 Ground surface Div. Ш Gust influence factor Gf= 2.5 Zb= 5  $Z_G =$ 450  $\alpha =$ 0.2 Installation period factor y= 0.827

For roof material design

Average speed pressure q' = 0.  $6Er2(Vex \cdot y)^2 = 283 \text{ N/m}^2$ 

4 Earthquake power

Earthquake power Qi=Z·Rt·Ai·Co·Wi

Area factorZ= 1.0
Vibration feature Rt= 1.0
Coat shear power distribution factorAi= 1.0

0.3

Standard shear power factorC<sub>o</sub> =

# 4. Preparing calculation

# 4-1 Carport load (For earthquake power calculation)

Roof	285	N
Post	72	N
Wi=	357	N

Earthquake power Qi=Z·Rt·Ai·Co·Wi=

107.1 N

# 4-2 Wind pressure power calculation (Maximum wind power pressure for 1 post)

# ·For design of structure frame

Wind factor

Independent shed

10°

C=

0.60 (+pressure)

-1.00 (-pressure)

1.2 (Post flat power, side panel)

Wind pressureW=q C=

425 N/m<sup>2</sup>

(Wind blow down)

-708 N/m<sup>2</sup> 849 N/m<sup>2</sup> (Wind blow up) (Flat)

·Roof material design

Peak with factor calculation process Gpe=

3.1 (+pressure)

3.0 (-pressure: panel center part)

4.0 (-pressure: panel surrounding part)

-1.00

Peak wind factor Cf=

3.1 x 0.60

1.86

3.0 x 4.0 x -1.00 =

=

-3.00 -4.00

Wind pressure W=q' Cf=

 $527 \text{ N/m}^2$ 

(Wind blow down)

 $-849 \text{ N/m}^2$ 

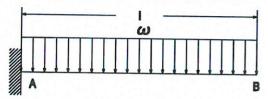
(Wind blow up)

 $-1132 \text{ N/m}^2$ 

(Wind blow up)

# 5. Beam material examination

# 5-1 Beam load(without support Vex=38m/s)



# Load chart

Туре			
Vertical load width (m)			1.506
I (m)	D-d1-	-d2	2.741
Load	Long perio	d load	90.4
ω(N/m)	Short perio	od load	994.0
	Short period blo	wing down(vertical)	729.9
	Short period blo	wing up(vertical)	-975.5
	Short period blo	wing down(horizontal)	133.8
	Short period ear	90.4	
	Short period ear	thquake(horizontal)	27.1
	Long period	d load	339.4
	Short perio	3733.9	
Bending moment	Short period blow	2741.8	
M(N·m)	Short period blow	wing up(vertical)	-3664.5
	Short period blow	wing (horizontal)	502.5
	Short period eart	thquake(vertical)	339.4
	Short period eart	101.8	
Maximum bending mon	maxMx	(long period)	
(N·m)		(short period)	3733.9
	maxMy	(long period)	
		(short period)	502.5
Second section momen			187.4
	Iy(cm <sup>4</sup> )		53.8
Section factor	Zx(cm <sup>3</sup> )		30.2
	Zy(cm <sup>3</sup> )		16.1
Elasticity factor	E(N/cm <sup>2</sup> )		7000000
Maximum bending stre	maxσx		123.6
	max σ y		31.3
Vertical maximum defo	12	(cm)	5.35
	max δ x/I		/ 81
Flat maximum deforma		(cm)	2.50
	max δ y/I	1,	/ 172

# 5-2 Beam permissible stress degree Bending permissible stress degree

		Permissible stress
		for short
	Permissible stress degree for long period (N/mm2)	period(N/m3)
bλ≦bλp	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	12.40	) cm
t=	0.22	2 cm
t1=	0.15	5 cm
b=	6.70	O cm
Young's modulus factor E=	70000	N/mm <sup>2</sup>
Shear elasticity factor of bending materialG=	27000	) Nmm
Torsion fixed number of bending material=	114.7	7 cm⁴
Second section moment around weak axis Iy=	53.847	7 cm <sup>4</sup>
Section factor of bending direction Z=	30.22	2 cm <sup>3</sup>
F: Standard strength (N/mm2) =	180	O N/mm <sup>2</sup>
b $\lambda = \sqrt{\text{(My/Me)}}$	0.14	<u>4</u>
$Me=C\sqrt{((\pi^2EIyGJ)/lb^2)}=$	291184326	S Nmm
Bending moment My=	5439600	
$C=1.75+1.05(M2/M1)+0.3(M2/M1)^2=$	1.75	5
M2=	0	O Nm
M1=	3664	4 Nm
M2/M1=	0	
M2/M1= Ib=	0 645.1	
		1 mm
lb=	645.1	1 mm
b=   $b \lambda p = 0.6 + 0.3 (M2/M1) =$   $b \lambda e = 1 / \sqrt{0}.5 =$	645.1 0.6 1.41	1 mm
$\begin{array}{c} {\rm lb} = \\ {\rm b}\lambda{\rm p} = 0.6 + 0.3 ({\rm M2/M1}) = \\ {\rm b}\lambda{\rm e} = 1/\sqrt{0}.5 = \end{array}$	645.1 0.6 1.41	ssumes 2.17 in case more than 2.17)

Permissible stress degree fb:  $F/\nu = 119.5 \text{ N/mm}^2$ 

Permissible stress degree at bend parts (strong axis)

# 1) Frange plate of beam <top/bottom face>

 $\Gamma$ b :The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Γb = 1.48

a) Гb ≦ 1.34

fb = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fb = F - 0.248F \Gamma b$ 

c) 2.69 < \Gamma b

 $fb = 2.41 F/(\Gamma b^2)$ 

fb=  $114.1 \text{ N/mm}^2$ 

# 2) Web plate of beam (side face)

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 4.04$ 

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

 $fb = 14.4 F/(\Gamma d^2)$ 

fb= 106.5 N/mm<sup>2</sup>
Therefore, result data is···

fbx= 106.5 N/mm<sup>2</sup>
fbx= 159.7 N/mm<sup>2</sup>

# Permissible stress degree at bend parts (weak axis)

# 1) Frange plate of beam <top/bottom face>

$$\lceil b := b/t \cdot \sqrt{(F/E)}$$

Γb = 4.04

a) Γb ≦ 1.34

fb = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

$$fb = F - 0.248F \Gamma b$$

c)  $2.69 < \Gamma b$ 

fb = 
$$2.41 \text{ F/}(\Gamma b^2)$$

2) Web plate of beam <side face>

$$\Gamma d$$
: The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

$$\Gamma d = 1.48$$

fb=

a) Γd ≦ 3.29

$$fb = F/1.5$$

b)  $3.29 < \Gamma d \le 6.57$ 

$$fb = F - 0.101F\Gamma$$

c) 6.57 < \Gamma d

fb = 14.4 F/(
$$\Gamma d^2$$
)

Therefore, result data is...

fby=	26.5 N/mm <sup>2</sup>	
fby=	39.8 N/mm <sup>2</sup>	

120.0 N/mm<sup>2</sup>

26.5 N/mm<sup>2</sup>

#### Section of the Beam examination

Snow for short period

M= 3733.9 N·m

 $\sigma b = 123.6 \text{ N/mm}^2$ 

 $\sigma b/fb = 0.77 < 1.0 OK!$ 

Wind blow down

M= 2741.8 N·m

 $\sigma bx = 90.7 \text{ N/mm}^2$ 

 $\sigma \, bx/fbx = 0.57 < 1.0 \, OK !$ 

Wind blow up

M= -3664.5 N·m

 $\sigma bx = 121.3 \text{ N/mm}^2$ 

 $\sigma \, bx/fbx = 0.76 < 1.0 \, OK !$ 

Wind blow horizontal

M= 502.5

 $\sigma$  by= 31.3

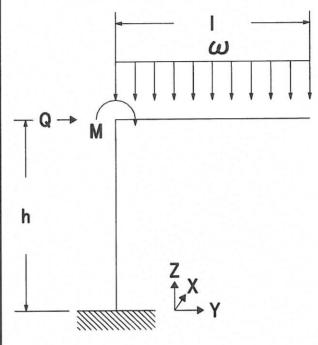
 $\sigma$  by/fby= 0.79 <1.0 OK !

# 6. Post material examination

# 6-1 Post load

Load chart

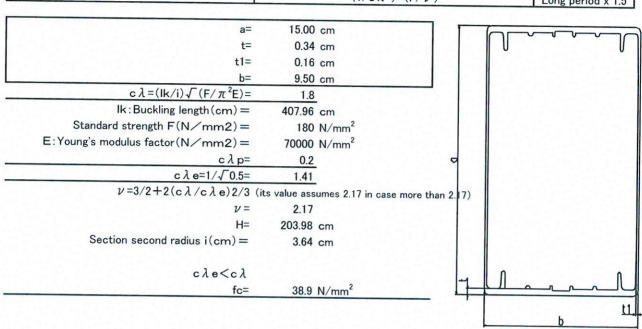
Load chart		
Type		1.506
Vertical load width (m)	D-d1	3.150
I (m)		90.4
	Long period load	994.0
Load	Short period snow load	729.9
ω(N/m)	Short period blowing down(vertical	
	Short period blowing up(vertical)	-975.5
	Short period earthquake(vertical)	90.4
	Long period load	370.5
Axial force	Short period snow load	3352.4
by vertical load	Short period blowing down(vertical	2480.9
N(N)	Short period blowing up(vertical)	-3146.8
	Short period earthquake(vertical)	370.5
Flat load	Short period wind X	677.5
Q(N)	Short period wind Y	626.2
	Short period earthquakeX、Y	85.4
	Long period load	448.3
Bending moment	Short period snow load	4931.3
M(N·m)	Short period blowing down(vertical	3621.1
	Short period blowing up(vertical)	-4839.6
	Short period earthquake(vertical)	448.3
Bending moment	Short period blowing down(vertical)+WindY	5030.0
by vertical and flat load	Short period blowing up(vertical)+WindY	-6248.6
Mx(N·m)	Short period earthquake(vertical) + Earthquak	640.4
Bending moment	Short period windX	1524.5
by flat load	Short period earthquakeX	192.1
My(N·m)		
Maximum bending	maxMx (long period)	
moment(N·m)	(short period)	6248.6
	maxMy (short period wind)	1524.5
	(short period earthquak	192.1
Second section moment	Ix(cm <sup>4</sup> )	475.041
	Iy(cm <sup>4</sup> )	161.02
Section factor	Zx(cm <sup>3</sup> )	63.339
	Zy(cm <sup>3</sup> )	33.90
Max. bending stress deg.		7.08
	Short period snow load	77.86
	Short period blowing down(vertical)	57.17
	Short period blowing up(vertical)	-76.41
	Short period earthquake(vertical)	7.08
	Short period blowing up(vertical)+WindY	79.41
	Short period blowing down(vertical)+WindY	-98.65
	Short period earthquake(vertical) + Earthquak	10.11
$max \sigma x (N/mm2)$	Long period	7.08
(uniaxial bending)	Short period(Y direction Vertical load)	98.65
Bending stress degree	Short period windX	44.97
Deficing Scress degree		



# 6-2 Post permissible stress degree

Permissible pressure stress degree

	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
cλ≦cλp	F/ν	Long period x 1.5
cλp <cλ≦cλe< td=""><td><math>(1.0-0.5((c\lambda-c\lambda p)/(c\lambda e-c\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></cλ≦cλe<>	$(1.0-0.5((c\lambda-c\lambda p)/(c\lambda e-c\lambda p)))F/\nu$	Long period x 1.5
cλe <cλ< td=""><td><math>(1/c \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></cλ<>	$(1/c \lambda^2) \cdot (F/\nu)$	Long period x 1.5



# Permissible stress degree at bend parts

# 1) Frange plate of beam <top/bottom face>

 $\Gamma b := b/t \cdot \sqrt{(F/E)}$ 

Γb = 1.37

a) Γb ≦ 1.34

fb = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fb = F - 0.248F \Gamma b$ 

c) 2.69 < \Gamma b

 $fb = 2.41 \, F/(\Gamma b^2)$ 

fc= 118.9 N/mm<sup>2</sup>

# 2) Web plate of beam <side face>

 $\Gamma d := d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 4.54$ 

fc=

a) Γd ≦ 1.34

fb = F/1.5

b)  $1.34 < \Gamma d \le 2.69$ 

 $fb = F - 0.248F\Gamma d$ 

c)  $2.69 < \Gamma d$ 

fb =  $2.41 \, \text{F/}(\Gamma \, \text{d}^2)$ 

Therefore, result date is \*\*\*

fc= 21.1 N/mm<sup>2</sup> fc= 31.6 N/mm<sup>2</sup>

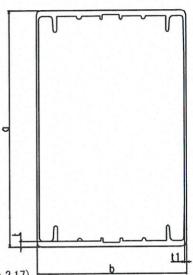
21.1 N/mm<sup>2</sup>

# 6-3 Permissible stress degree at bend parts

Permissible bending stress degree

	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
bλ≦bλp	F/V	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
b λ e < b λ	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	15.00	cm
t=	0.34	cm
t1=	0.16	cm
b=	9.50	cm
Young's modulus factor E=	70000	N/mm <sup>2</sup>
Shear elasticity factor of bending material G=	27000	Nmm
Torsion fixed number of bending material=	314.8	cm <sup>4</sup>
Second section moment around weak axis ly=	161.022	cm <sup>4</sup>
Section factor of bending direction Z=	63.339	cm <sup>3</sup>
F: Standard strength(N/mm2) =	180	N/mm <sup>2</sup>
b $\lambda = \sqrt{\text{(My/Me)}} =$	0.27	
$Me=C\sqrt{((\pi^2EIyGJ)/lb^2)}=$	161021364	Nmm
Bending moment My=	11401020	Nmm
$C=1.75+1.05(M2/M1)+0.3(M2/M1)^2=$	1	
M2=	-4839.6	Nm
M1=	4839.6	Nm
M2/M1=	-1	
lb=	1909.8	mm
$b \lambda p=0.6+0.3(M2/M1)=$	0.3	
b λ e=1/√0.5=	1.41	



 $\nu = 3/2 + 2 \left( \frac{b \lambda}{b \lambda} \frac{\lambda}{e} \right)^2 / 3$  (its value assumes 2.17 in case more than 2.17)

 $\nu = 1.52$ 

ьλ≦ьλр

Permissble stress degree fb:  $F/\nu = 118.1 \text{ N/mm}^2$ 

# Permissible bending stress degree (strong axis)

# 1) Frange plate <top/bottom face>

 $\Gamma$  b :The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

 $\Gamma b = 1.37$ 

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma b$ 

c)  $2.69 < \Gamma b$ 

 $fc = 2.41 F/(\Gamma b2)$ 

fb= 118.9 N/mm<sup>2</sup>

# 2)Web plate <side face>

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 4.54$ 

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F \Gamma d$ 

c) 6.57 <  $\Gamma$  d

fb =  $14.4 \, F/(\Gamma d^2)$ 

fb=  $97.5 \text{ N/mm}^2$ 

Therefore, result date is\*\*\*

fbx= 97.5 N/mm<sup>2</sup>
fbx= 146.2 N/mm<sup>2</sup>

# Permissible bending stress degree (weak axis)

# 1) Frange plate <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

a) Γb ≦ 1.34

$$fc = F/1.5$$

b) 
$$1.34 < \Gamma b \le 2.69$$

$$fc = F - 0.248F\Gamma d$$

c) 2.69 <  $\Gamma$ b

$$fc = 2.41 F/(\Gamma d2)$$

# $o = 21.1 \text{ N/mm}^2$

#### 2) Web plate (side face)

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

$$\Gamma d = 1.37$$

fb=

a)  $\Gamma d \leq 3.29$ 

$$fb = F/1.5$$

b)  $3.29 < \Gamma d \le 6.57$ 

$$fb = F - 0.101F\Gamma d$$

c) 6.57 < \Gamma\d

fb = 
$$14.4 \text{ F/}(\Gamma d^2)$$

Therefore, result date is •••

fby=	21.1 N/mm <sup>2</sup>
fbv=	31.6 N/mm <sup>2</sup>

120.0 N/mm<sup>2</sup>

# Examination of the section of the post

Short period snow load

Wind blow down

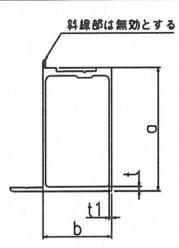
Wind blow up

# 7. Main Frame Bending permissible stress degree

7-1 Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
b λ ≦b λ p	F/ <i>v</i>	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	4.60
t=	0.10
t1=	0.09
b=	2.50
Young's modulus factor E=	70000
hear elasticity factor of bending materialG=	27000
Torsion fixed number of bending material=	3.2
Second section moment around weak axis Iy=	2.072
Section factor of bending direction Z=	2.274
F: Standard strength $(N/mm2) =$	180
b $\lambda = \sqrt{\text{(My/Me)}}=$	0.27
Me=C√(( $\pi$ 2EIyGJ)/lb2)=	5535840
Bending moment My=	409320
C=	1.13
lb=	715
$b \lambda p = 0.6 + 0.3 (M2/M1) =$	0.3
b λ e=1/√0.5=	1.41



 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

1.52  $\nu =$ b λ ≦b λ p

118.1 N/mm<sup>2</sup>

# Permissible stress degree at bend parts

#### 1) Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

0.41 Гь =

a)  $\Gamma b \leq 0.438$ 

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c)  $0.876 < \Gamma b$ 

 $fb = 0.256 F/(\Gamma b^2)$ 

120.0 N/mm<sup>2</sup> fb=

 $\Gamma b$ : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

1.18

a) Гb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F\Gamma d$ 

c)  $2.69 < \Gamma b$ 

 $fc = 2.41 F/(\Gamma d2)$ 

120.0 N/mm<sup>2</sup> fb=

# 2) Wave plate of beam <side face>

 $\Gamma$ b : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

Γd= 2.48

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

 $fb = 14.4 F/(\Gamma d^2)$ 

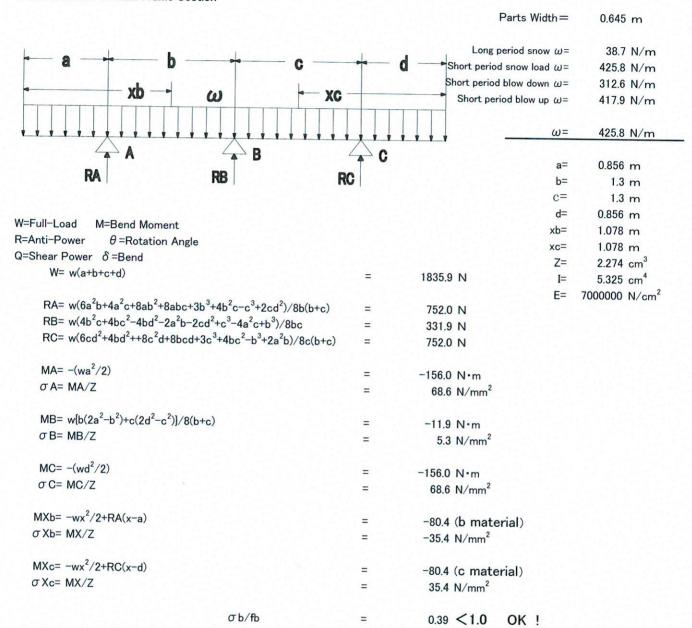
fb=

Therefore, result data is...

118.1 N/mm<sup>2</sup> fb= 177.1 N/mm<sup>2</sup>

120.0 N/mm<sup>2</sup>

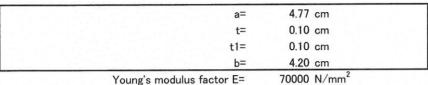
# 7-2 Calculation of Main Frame Section



#### 8. Front frame bending permissible stress degree

8-1 Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
ьλ≦ьλр	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5



Young's modulus factor E= 70000 N/mm<sup>2</sup>

Shear elasticity factor of bending materialG= 27000 Nmm

Torsion fixed number of bending material= 8.4 cm<sup>4</sup>

Second section moment around weak axis Iy= 6.911 cm<sup>4</sup>

Section factor of bending direction Z= 3.805 cm<sup>3</sup>

F: Standard strength (N/mm2) = 132 N/mm<sup>2</sup>

b  $\lambda = \sqrt{(My/Me)} = 0.17$ 

b λ = √ (My/Me) = 0.17Me=C√((π 2EIyGJ)/lb2)= 16407392 Nmm

Bending moment My= 502260 Nmm

C= 1.13

| Ib= | 715 mm |  $b \lambda p = 0.6 + 0.3 (M2/M1) = | 0.3 |$  |  $b \lambda e = 1/\sqrt{0.5} = | 1.41 |$ 

 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

$$\nu = 1.51$$

bλ≦bλp

fb= 87.4 N/mm<sup>2</sup>

t1

#### Permissible stress degree at bend parts

# 1) Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

$$\Gamma b = 1.74$$

a) Γb ≦ 1.34

$$fc = F/1.5$$

b)  $1.34 < \Gamma b \le 2.69$ 

$$fc = F - 0.248F \Gamma d$$

c)  $2.69 < \Gamma b$ 

$$fc = 2.41 F/(\Gamma d2)$$

fb=  $75.1 \text{ N/mm}^2$ 

# 2) Web plate of beam <side face>

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

$$\Gamma d = 1.98$$

a) Γd ≦ 3.29

$$fb = F/1.5$$

b)  $3.29 < \Gamma d \le 6.57$ 

$$fb = F - 0.101F\Gamma$$

c)  $6.57 < \Gamma d$ 

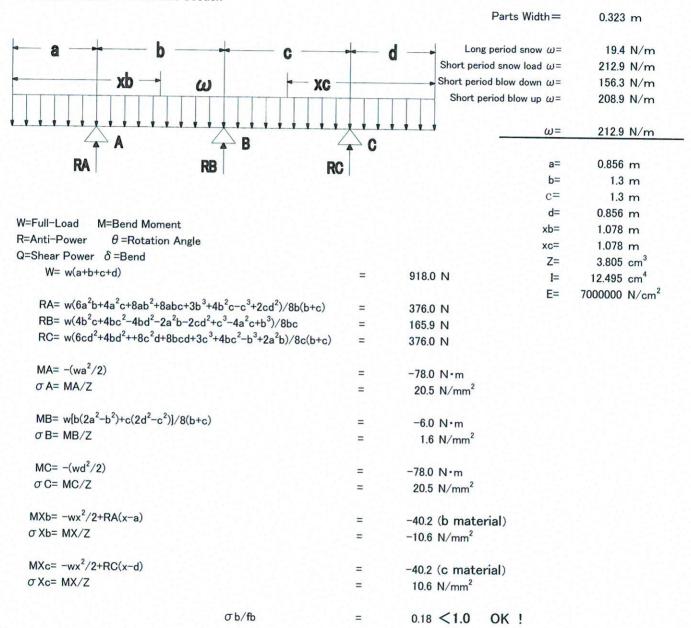
fb = 14.4 F/(
$$\Gamma d^2$$
)

fb= 88.0 N/mm<sup>2</sup>

Therefore, result data is...

fb=	75.1 N/mm <sup>2</sup>	
fb=	112.7 N/mm <sup>2</sup>	

# 8-2 Calculation of Front Frame Section



#### 9. Bending permissible stress degree at rear frame

#### 9-1 Calculation method of effective section

 $\Gamma b = b/t \cdot \sqrt{(F/E)} = 0.438$ 

 $b/t = 0.438/\sqrt{(F/E)} = 10.09$ 

Effective Depth

1.70 mm

t2= b1=

17.15 mm

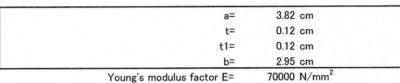
Therefore...

#### 9-2. Bending permissible stress degree at rear frame

Bending permissible stress degree

bending permissible stress degre		1
	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
b λ ≦b λ p	F/ <i>ν</i>	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

斜線部は無効とする



Shear elasticity factor of bending materialG=
Torsion fixed number of bending material=
Second section moment around weak axis Iy=
Section factor of bending direction Z=
F: Standard strength(N/mm2) =  $b \lambda = \sqrt{(My/Me)} = \frac{7000 \text{ N/mm}}{27000 \text{ N/mm}}$ 

Me=C√(( $\pi^2$ EIyGJ)/lb²)= 12025195 Nmm Bending moment My= 309408 Nmm C= 1.13

| Ib= | 715 mm |  $b \lambda p = 0.6 + 0.3 (M2/M1) = | 0.3 |$  |  $b \lambda e = 1/\sqrt{0.5} = | 1.41 |$ 

 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

0.98

 $\nu = 1.51$ 

bλ≦bλp

fb=

87.5 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

# 1) Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

b =

a) Гb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c) 2.69 <  $\Gamma b$ 

 $fc = 2.41 \, F/(\Gamma \, d2)$ 

c) 2.69 < 1 b

fb= 88.0 N/mm<sup>2</sup>

fb=

## 2) Web plate of beam <side face>

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 1.30$ 

a) Γd ≤ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

fb = 14.4 F/( $\Gamma d^2$ )

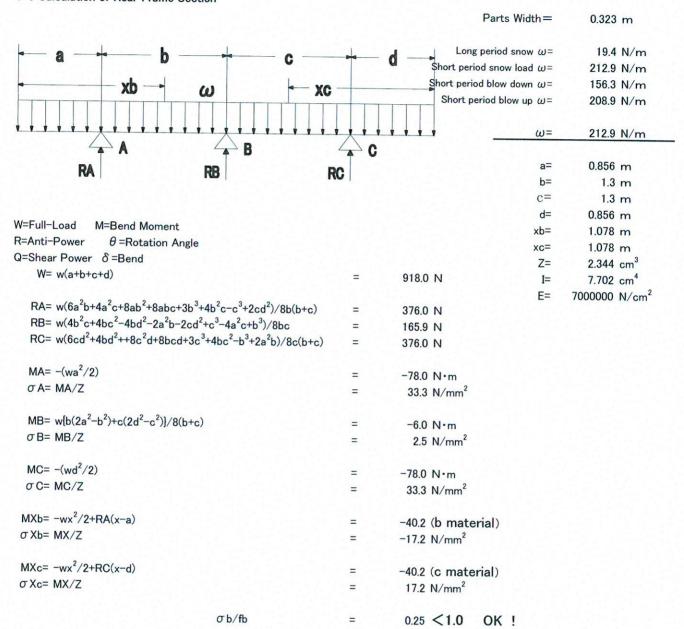
Therefore, result data is...

fb= 87.5 N/mm<sup>2</sup>

fb= 131.2 N/mm<sup>2</sup>

88.0 N/mm<sup>2</sup>

# 9-3 Calculation of Rear Frame Section



# 10. Rafter / Roof retainer bending permissible stress degree

10-1 Bending permissible stress degree

o i Deliding perini	SSIDIO SCI OSS GOBI CO		_
	a=	1.30 cm	
	t=	0.10 cm	
	t1=	0.17 cm	
	b=	0.72 cm	
	b1=	1.99 cm	

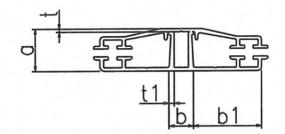
Young's modulus factor E= 70000 N/mm<sup>2</sup>

Shear elasticity factor of bending materialG= 27000 Nmm

Second section moment around weak axis Iy= 0.364 cm<sup>4</sup>

Section factor of bending direction Z= 0.529 cm<sup>3</sup>

F: Standard strength(N/mm2) = 132 N/mm<sup>2</sup>



Therefore···

fb= 88.0 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

# Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

a) Γb ≦ 0.438

$$fb = F/1.5$$

b)  $0.438 < \Gamma b \le 0.876$ 

$$fb = F - 0.760F \Gamma b$$

c) 0.876 <  $\Gamma$ b

fb = 
$$0.256 \, F/(\Gamma \, b2)$$

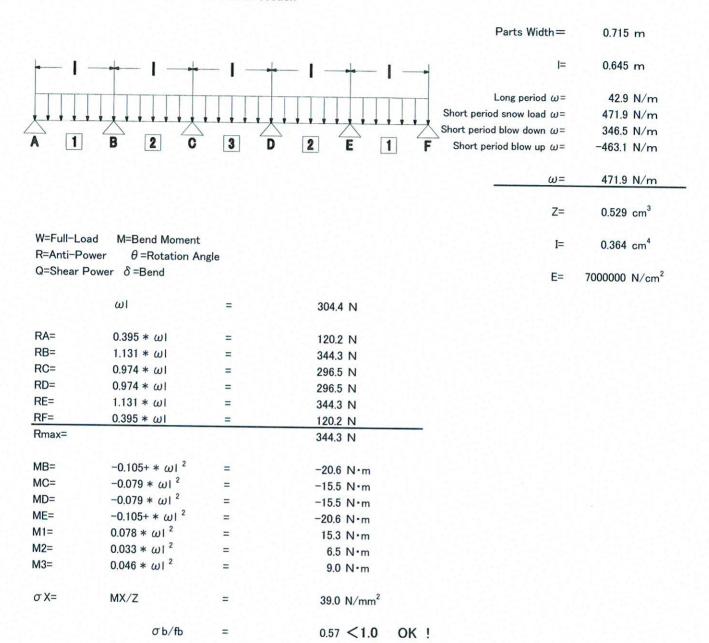
fh=

45.3 N/mm<sup>2</sup>

Therefore···

fb=	45.3 N/mm <sup>2</sup>	
fb=	68.0 N/mm <sup>2</sup>	

10-2 Calculation of Rafter / Roof retainer section



# 11. Side frame bending permissible stress degree

# 11-1 Calculation method of effective section

 $\Gamma b = b/t \cdot \sqrt{(F/E)} = 0.438$  $b/t = 0.438/\sqrt{(F/E)} = 10.09$ 

Therefore...

(5)[

斜線部は無効とする

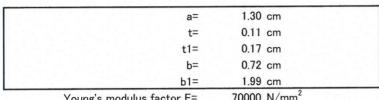
Effective Depth

t2=

1.20 mm

b2= 12.10 mm

#### 11-2 Bending permissible stress degree



70000 N/mm<sup>2</sup> Young's modulus factor E=

Shear elasticity factor of bending materialG=

27000 Nmm

Second section moment around weak axis ly=

2 cm<sup>4</sup>

Section factor of bending direction Z=

 $0.324 \text{ cm}^3$ 

F: Standard strength (N/mm2) =

132 N/mm<sup>2</sup>

#### Therefore...

fb =

88.0 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

# Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

Гь = 0.79

a) Γb ≤ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c) 0.876 < \Gamma b

fb =  $0.256 \, \text{F/(} \, \Gamma \, \text{b2)}$ 

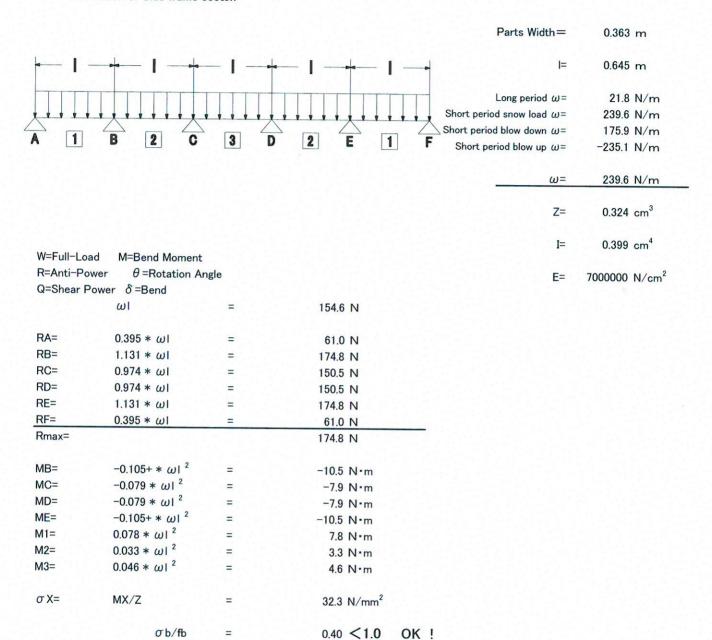
fb=

53.2 N/mm<sup>2</sup>

Therefore...

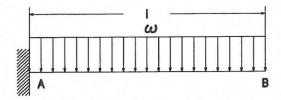
53.2 N/mm<sup>2</sup> fb= fb= 79.8 N/mm<sup>2</sup>

11-3 Calculation of Side frame secton



# 12. Corner bracket examination

# 12-1 Beam load



# Load chart

Туре			
Vertical load width (m)			1.506
I (m)	D-c	11	3.225
Load	Long period	load	90.4
ω(N/m)	Short period	d snow load	994.0
	Short period blow	ing up(vertical)	729.9
	Short period blow	ing up(vertical)	-885.1
	Short period blow	ing down(horizontal)	160.5
	Short period earth	nquake(vertical)	90.4
	Short period eart	nquake(horizontal)	27.1
	Long period	load	469.9
	Short period	d snow load	5168.9
Bending moment	Short period blow	ing up(vertical)	3795.5
M(N·m)	Short period blow	ing up(vertical)	-4602.9
	Short period blow	ing down(horizontal)	834.7
	Short period eart	hquake(vertical)	469.9
	Short period eart	hquake(horizontal)	141.0
Maximum bending momer	maxMx	(long period)	
(N·m)		(short period)	5168.9
	maxMy	(long period)	
		(short period)	834.7
Second section moment	Ix(cm <sup>4</sup> )		187.4
	Iy(cm <sup>4</sup> )		53.8
Section factor	Zx(cm <sup>3</sup> )		30.2
	Zy(cm <sup>3</sup> )		16.1
Elasticity factor	E(N/cm <sup>2</sup> )		21000000
Maximum bending stress degree	max σ x		171.0
(N/mm2)	max σ y		51.9
Vertical maximum deformation quantity	max δ x	(cm)	3.42
	max δ x∕I	1/	126
Flat maximum deformation quantity	max δ y	(cm)	1.92
	max δ y ∕ I	1/	225

# 12-2 Calculation of Corner bracket Section

Makadal	Second sec	tion moment	Section	n factor
Material	Ix(cm4)	ly(cm4)	Zx(cm3)	Zy(cm3)
GB8064	205.211	65.073	28.119	20.335

fb= 420 N/mm<sup>2</sup>
Mx= 5168.9 N·m
My= 834.7 N·m

σbx= 183.8 N/mm<sup>2</sup>
σby= 41.0 N/mm<sup>2</sup>

σbx/fb= 0.44 < 1.0 OK!
σby/fb= 0.10 < 1.0 OK!

# 13. Examination of main frame connecting part

P2=

# 13-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

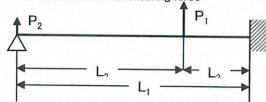
P1= 344.3 N ←from "Calculation of rafter"

·Anti-Power of connecting rafter

172.2 N

←(Anti-Power of rafter)/2

# 13-2 Examination of shearing force



L <sub>1</sub> (m)	0.86
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.14
A(mm²)	276.8
fs(N/mm <sup>2</sup> )	76.2

$$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + U_3^2$$

185.4 N

 $\tau = Q/A =$ 

0.67 N/mm<sup>2</sup> 0.01 < 1.0

T /fs=

OK!

# 14. Examination of front frame connecting part

#### 14-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

P1=

120.2 N

←from "Calculation of rafter"

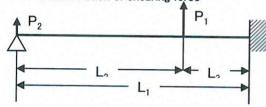
· Anti-Power of connecting rafter

P2=

60.1 N

←(Anti-Power of rafter)/2

# 14-2 Examination of shearing force



0.86
0.715
0.14
261.6
76.2

$$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_3$$

Q=

64.7 N

 $\tau = Q/A =$ 

0.25 N/mm<sup>2</sup>

T /fs=

0.01 < 1.0

OK!

# 38

2.1

21.8

# 15. Examination of gutter connecting part

# 15-1 Calculation of Load

· Anti-Power of rafter

P1=

120.2 N

←from "Calculation of rafter"

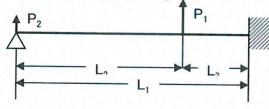
·Anti-Power of connecting rafter

P2=

60.1 N

←(Anti-Power of rafter)/2

# 15-2 Examination of shearing force



L <sub>1</sub> (m)	0.86
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.14
A(mm <sup>2</sup> )	192.1
fs(N/mm <sup>2</sup> )	76.2

 $Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_3$ 

Q=

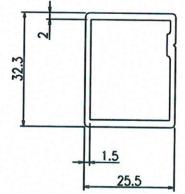
64.7 N

 $\tau = Q/A =$ 

0.34 N/mm<sup>2</sup>

T /fs=

0.01 < 1.0OK!



#### 16. Examination of main frame and beam connection

# 16-1 Examination of screw pull-out force

·Pull-out force/screw

T= 376.0 N

Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2-d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $172.7 \text{ N/mm}^2$ 

Effective section

A=  $11.2 \text{ mm}^2$  $\sigma t= 33.5 \text{ N/mm}^2$ 

 $\sigma t/ft = 0.19 < 1.0 OK!$ 

β	0.6
Screw diameter	5
Core diameter	3.78
Pitch	0.8
t(Thickness)	4.6
Ft(Standard strength)	100

# b (Beam depth dimension) 61 t(Thickness) 2.4 a (load point) 18.5

# 16-2 Examination of Beam bending stress

\*Beam top face bending moment

 $\begin{array}{lll} M = & 2109.6 \ N \cdot mm \\ Z = & 58.6 \ mm^3 \\ \sigma \, b = & 36.0 \ N/mm^2 \\ \end{array}$ 

 $\sigma$  b/fb= 0.17 < 1.0

# 17. Examination of rafter and main frame connection

OK!

OK!

# 17-1 Examination of screw pull-out force

·Pull-out force/screw

T= 344.3 N

Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $104.5 \text{ N/mm}^2$ 

· Effective section

A=  $6.7 \text{ mm}^2$   $\sigma t= 51.1 \text{ N/mm}^2$  $\sigma t/\text{ft}= 0.49 < 1.0 \text{ OK } !$ 

# 17-2 Examination of Main frame bending stress

· Main frame top face bending moment

M= 991.6 N·mm Z= 22.0 mm<sup>3</sup> σ b= 45.0 N/mm<sup>2</sup> σ b/fb= 0.22 < 1.0

 b (Beam depth dimension)
 25

 N⋅mm
 t(Thickness) center
 2.3

 mm³
 a (load point)
 10

# 18. Examination of Roof material

# 18-1 Examination of Bending volume

Poisson ratio :  $\nu =$ 0.3 Bending volume: Wmax Distribution Load : P= 0.0116 kgf/cm<sup>2</sup> A-Wmax3+B-Wmax+C=0 E: Young's modulus factor = 21000 kgf/cm<sup>2</sup> Thickness:h= 0.18 cm  $A = (4 \nu /a^2 b^2 + (3 - \nu^2) \cdot (1/a^4 + 1/b^4))/h^3$ Short edge a= 70.3 cm 2086.4 Long edge b= 326.4 cm  $B = (4/3) \cdot (1/a^2 + 1/b^2)^2/h$ 33.2  $C = -256(1 - \nu^2)P/(\pi^6Eh^4)$ -12701.0Bending volume : Wmax= 1.82 cm

18-2 Bending stress degree

# 18-3 Necessary depth of insert

Necessary depth of insert  $\Delta L$ 

 $\Delta L = \Delta X \times SF + \Delta I$ 

However,  $\Delta X$ : The gap volume by a bend

= (lx - b)/2

Ix : Arc length while bending

 $= 2 \times \sin(-1(b/2)/r) \times r$ 

r : Radius rate while bending

 $= (b2+4\delta 2)/8\delta$ 

 $\delta$ : Bending rate of Polycarbonate = Wmax (cm)

b : Length of short (cm)

 $\Delta\,I$  : The volume of expansion and contraction at temperature

 $= K \cdot \Delta t \cdot b/2$ 

K : Line coefficient of expansion (cm/cm/°C)

∆t : Temperature differency at 50°C

SF: Safety ratio SF=3. 0

ΔL=

r= 339.8 Ix= 70.43 cm  $\Delta X =$ 0.06 cm K= 0.00007 cm/cm/°C  $\Delta t =$ 50 °C SF= 3.0 **∆** I= 0.12 cm

Therefore...

19. Examination of Roof retainer Rafter pitch= 715 mm Supporting length I= 15 mm Material thickness t= 1.2 mm F: Standard strength = 132 N/mm<sup>2</sup> Blow up load  $\omega =$ 383.4 N/m Load  $P = \omega b =$ 3.834 N M=P-I= 5.8 Ncm Section factor Z=bt<sup>2</sup>/6=  $0.002 \text{ cm}^3$  $\sigma b=M/Z=$ 24.0 N/mm<sup>2</sup>  $\sigma b/fb=$ 0.18 < 1.0

1.89 cm

..ok!

0.31 cm depth or more

OK!

20. Ground Foundation

Resistance moment  $M_R=(N+W) \times e+q^{'}s \times b \times h_1 \times (h_1+h_0)$ 20-1 Without concrete floor

M<sub>R</sub>=(N+v, .
Resistance moment
M=M'+Q\*(h/2)-N × (d/2-a)
Base Foundation
Lateral Pressure
b= 하는 무무 Short Term Permissible Endurance strength of ground q= No line concrete Volume weight Endurance strength of ground Fe=

	E	Ε	E	E	E	KN/m <sup>2</sup>	KN/m <sup>2</sup>	KN/m3
0.5	06.0	1.10	0.55	0.30	0.45	100	200	225

hl

(入断面)

×	 		-×	r
Q ×	 			
	>		' — 	<b>-</b>
		ದ		Í
	p			į

h/2

-- h-

Z Ø

×

	Spindle Force(N)	Shear power(N)	er(N)	Momen	nt(Nm)		Foundation size(m)	size(m)		Base Weight	Endurance strength of ground	Lateral Pressure
	Z	ć	à	N, ×	, M	p	Ф	٦	a	W(N)	q'(kN/m2)	's(kN/m2)=0.5c
	2000		200	0000	00	000	110	0.55	0.30	12.251	100	20.0
Long period load	3/0.5	0.0	0.0	440.0	0.0	0.0		0 0	000	10051	000	
Lac Loison tropo	3352 4	0.0	0.0	4931.3	0.0	06.0	1.10	0.55	U.3U	167'71	007	
Short period load	370 5	85.4	00	4483	192.1	06.0	1.10	0.55	0.30	12,251	200	
Short term earthquake A	3070		0.5 A	640.4	00	060	1.10	0.55	0.30	12,251	200	100.0
Short term earthquake Y	0.000	3.7.5		2691 1	15245	060	110	0.55	0.30	12,251	200	
Short period blow down + Holizontal	2480.9	0.770	0.00	2000	0.170	000	110	0.55	030	12.251	200	100.0
Short period blow down + Holizontal	2480.9	0.0	7.070	2020.0	0.0	000	2 3	0 0	000	10051	000	
Short period blow up+Holizontal X	-3146.8	677.5	0.0	-4839.6	1524.5	0.90	01.1	0.00	0.30	10,231	007	
Y letroriothous wold boises todo	-3146.8	0.0	-626.2	-6248.6	0.0	06.0	1.10	0.55	0.30	167,21	2002	
מוסר המוסר ה												

subsidence load		Endurance strength of ground	
(N) M+N	1	$p \times d \times q$ (N)	
15604	/	198000	OK !

Base >	t load Base weight	camination of uplift (short period blow up)
--------	--------------------	---

Lyallilladoll of aprile (slic) t police are a	3ase weight	$b \times d \times h \times \gamma(N)$	12251 OK!
inde io	Bas	P×q/	/
Lyallillacion	uplift load	(N) N	3147

				X direction	lon				
	t(m)	e(m)	h0(m)	h1(m)	Resistance MRx	Fall Mx		JUDGMENT	MENT
	(N+W)/(P × d.)	(d-t)/2	Qy/(b×q's)	(h-h0)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MR∥≥M	Σ
in a land	0.140	0.480	00000	0.275	9,460	355.7	0.038		ð
ing period load	0.087	0.507	0000	0.275		4093.2	0.278		ŏ
Short period load	0.070	0.515		0.275		355.7	0.027		š
ort term earthquake >	0.070	0.515	0.001	0.275		571.3	0.043		ŏ
Short term earthquake		0.509	0000	0.275		3000.8	0.210		엉
Short period blow down + holizontal x	0.082	0.509	0.007	0.272		4582.0	0.320		송
Short period blow unt-Holizontal X		0.525	0000	0.275		-4052.9	0.350		송
Short period blow up+Holizontal Y	0.051	0.525	0.007	0.272	11,582	-5634.1	0.486	0.10	ş

				1 direction	JII.				I
	+(m)	e(m)	h0(m)	h1(m)	Resistance MRx	Fall Mx		JUDGMENT	<b>JENT</b>
	(N+W)/(d×a')	(b-t)/2	Qx/(d×a's)	(h-h0)/2	MRy(N·m)	My(N·m)	My/Mry	MR≧M	Σ
	16	- 112					0.70	011	-
Chort tom couther sky	0.057	0.421	0.001	0.275	12,124	215.6	0.018 < 1.0	0.1 >	- Y
Office term cal unduand A							0070	0	1
X letacrited + mode well beings to 42		0.417	9000	0.272	12,942		0.132	0.1 >	5
SHOLL DEFINE DIOM COMPLET FINITE SHIPE							0010	0 , 1	- >10
Short period blow up+Holizontal X	0.041	0.429	900'0	0.272	10,714		0.160	0.1	5
do topological									

21-1 With concrete floor

Resistance moment  $M_R=(N+W) \times e+q's \times b \times h_1 \times h_1/2$ 

M=M' +Q\*(h/2) Fall moment

Base Foundation 급유분 Lateral Pressure Concrete floor thickness t=

0.60 m 0.45 m 0.55 m 0.45 m 0.35 m 0.10 m 50 KN/m<sup>2</sup> 100 KN/m<sup>3</sup> 15000 KN/m<sup>3</sup> No line concrete Volume weight  $\gamma=$  Concrete standard strength Fc= Endurance strength of ground Fe= Short Term Permissible Endurance strength of ground q=

	, p
 A	
	9
	, o
 h1	(国蝠人)

		Y Qy		(国土)
$\bigcirc$ $\bigcirc$ $\bigcirc$ $\bigcirc$ $\bigcirc$	×		X	p
		P V		:綠端距離

	Spindle Force(N)	Shear power(N)	(N)	Moment(Nm)	(Nm)		Foun	Foundation size(m)			Base Weight	Endurance strength of	Lateral
	z	ŏ	ć	N/ ~	NA'	-						ground	
Long period load	3705	0		× 1	N N	0	P	h nd r	nd part lengtloor thicknes		(N) M	"(LN/m2)	0'(LN /mg) 1'2(LN /mg)=0 E
	0.070	0.0	0.0	448.3	00	090	0.45	0 55	100	ı	1	(VIII/) 1117)	S(KIN/ IIIZ)-U.DC
Short period load	3352.4	0.0	00	4031 2	0	000	2.5	0.00	0.35	0.10	3,341	20	25.0
Short term earthouske X	3070	7 10	2	0.	0.0	0.00	0.45	0.55	0.35	0.10	2 2/11	00+	
C Outphis in	0.070	85.4	0.0	448.3	1921	080	0 45	200	0 0	5	1,0,0	201	20.00
Short term earthquake Y	3705	C	A 30	1010		0.0	0.40	0.00	0.35	0.10	3.341	100	005
Chort and Line		0.0	4.00	40.4	0.0	09.0	0.45	0.55	0.05	0		2	0.00
Strort period blow down + Holizontal >	2480.9	677.5	00	3621 1	1594 E	000	2 1	0.00	0.00	0.10	3,341	100	20.0
Short period blow down + Holizontal N	2480 9	00	6060	- 200	0.4201	0.00	0.45	0.55	0.35	0.10	3.341	1001	200
S. T. T. T. T. T. C. T. C. T. C. T. C. C. C. T. C.	0.00	0.0	7.070	2030.0	0.0	09.0	0.45	0.55	0.25	0,0		2	0.00
orior period blow up+Holizontal X	-3146.8	677.5	0.0	-4839 6	1524 5	080	24.0	0 1	0.00	0.10	3,341	100	20.0
Short period blow up+Holizontal Y	-3146 8	0	0000	0000	0.1.0	0.00	0.43	0.55	0.35	0.10	3 341	100	000
	0.01	0.0	7.070-	-0.248.6	0.0	09.0	0.45	0 55	0.05			3	0.00
							2	00.0	0.00	0.10	3,341	100	20.0

ort period snow)			oK!	
(amination of subsidence (short period snow	Endurance strength of ground	(N) bxpxq	27000	
of		1		
■Examination	subsidence load	(N) M+N	6694	

lare force	Г	e force
	1	politicalizar a large lorge
2	-	15×fe×+×001×2/N)
()	V	(N) X \ 10.0 \ 7 \ X \ 10.0
47490	7	

- X Concrete floor bearing

are force		re force bearing capacity
(N)	1	$f_{c} \times b \times 0.875t/2(N)$
47490	/	1 710 . 003636

				X direction				
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		HIDGMENT.	AFNIT
	N+W(N)	$(N+W)/(b \times q')$	(d-t)/2	MRx (N·m)	1	My/MD	AAD VAA	2
Long period load	3711.7	0.124	0.163	D 12A	1101	A LIM AND	1	2
Short period load	2 6028		000	4717	1.7.1	0.053	0.1 >	Š
000000000000000000000000000000000000000	0.000		0.169	4,170	1232.8	→ 966 0	<10	S
Short term earthquake X	3711.7	0.062	0.194	3.758	1121	0000	2 .	5 8
Short term earthquake Y	3711.7	0.062	0 194		1600	0.000		5
Chart and J. L.	10001		5	0,1,0	102.2	0.043	0.	Š
Short period blow down + Holizontal X	2822.1	0.097	0.176	4.065	9053	0000	01/	100
Short period blow down + Holizontal	50001	7000	0170		0.000	0.22.0		5
The state of the s	3022.1		0.1/0	4,065	1273.1	0.313	<10	OK
Short period blow up+Holizontal X	194.4	0.003	0.223	3.081	-12000	0000		3
Short pariod blom	7 707	0000		000	200.0	0.030	0.1/	5
orior period plow up+nolizontal 1	134.4	0.003	0.223	3,081	-1577.8	0.512	V10	S
								5
				Vairantion				l

				Vdirection				
		,		I dil cocioni				
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		IIIDGMENT	FN
	(Z)M+Z	(N+W) /(h > ~!)	0/(TP)	14) 074			The Coop	
	(1)	1	7/(1_D)	(H.N)XYN	(E.V)×N	Mx/MRx	MPVM	2
Short term earthquake X	3711.7	0.082	0.259	3 008	200	0.00	-	
			001	0,000	200	0.013	0.	Š
Short period blow down + Holizontal >	5822.1	0.129	0.235	4 408	1002	0000	0 . /	
				1, 100	1.000	0.030	2./	- K
Short period blow up+Holizontal X	194.4	0.004	0.298	3 0 9 5	308 1	0010	0 100 / 100	- >
			2	0,000	1.000	0.123		_



AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Wichinger	ocuii.														
T only															
	Dundunt		Tension		Compressio	r	Sh	ear			Bea	ring	1909/1009/100	Modul	us of E
Alloy and tamper	Product	Ftu	Fty		Fcy	Fsu		Fsy		Fbu		Fby		E	
6063 T6	Extrusions	-	207	172	177		131		96		434		276		70000

180

T-	L 1	-	2	2	10)	D	e 20

Type of member stress	77-	Intercept		Slope	In	itersection
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859
Ultimate strength of flat plates in compression						
Ultimate strength of flat plates in bending	k1 k1	0.35		2.27		

Table 3.4 (A) Page 21

Factor of safety	Normal buildings
φу	0.95
φu	0.85
φνр	0.9
φb	0.85
Ψū	0.00
фср	0.8
φw	0.9
φς	0.85
φν	0.8
фсс	see below

Table 3.4 (b) Page 21

1.12

RHS/SHS section properties

Effective Length (m)

2750 mm between restraints

Height

150 mm

Width

95 mm

Walls side (avg if

complex shape)

1.6 mm

Walls top/bottom (average is complex

shape)

3.4 mm

CM (CANTAPORT)

4750400 bx

475.04

ly	1610200	161.02
J (Torsion constant		
(warp))	3148000	314.8
Zx	63340	63.34
Zy	33900	33.9
Area	1215	12.15
Radius of gyration		
Rx	62.52834748 mm	
Radius of gyration		
Ry	36.40422351 mm	

# Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 154.7331887

Zc 63340 Assumed to be Zx

\$1 1.792654179 \$2 2417.766287

mp

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<! 144.834964 mPa Add tripple to one formula

136.30 + 53 340

Equ-3.4.15(3): S2>N 1482.879585 mPa

# MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 23.88818404 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 23.88818404 Rye 115.119676

4.9 compression in single web beams and beams having sections containing tubular portions

rye 115.1196757

S1 -2.570688695 S2 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 144.8314837 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 1482.263951 mPa

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

# NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 89.5 143.2 S1 38.36639146 S2 90.53212769

Equ-3.4.22(1): N<S1 190.06 Equ-3.4.22(2): S1<N<5 136.3025247 Equ-3.4.22(3): S2>N 136.2373351

Add tripple to one formula

Add tripple to one formula

one.

#### FLANGE

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 27 H 91.8

S1 12.41378457

52 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<: 139.5847376 mPa Equ-3.4.17(3): S2>N 156.1068592 mPa

# Compression capacity

# 3.4.8.1-Genreal

 compression

 k
 1

 Dc
 62.79993051

 S1
 0.581870399

 S2
 1.241183988

 λx
 0.693848678

 λy
 1.191763127

 X-X
 y-y

 φcc limits λ<1.2</td>
 0.854291778
 0.74972974

 φcc limits λ<1.2</td>
 0.854291778
 0.74972974

 φcc limits λ>1.2
 0.677138815
 0.74684684

X-X Y-Y

Equ-3.4.8.1 (1) N<s1 131.1948087 115.137068 mPa 103.9891752 114.694336 mPa

103.9891752 114.694336 mPa Red through Equ-3.4.8.1 (2) s1<n<: 125.187234 86.4215032 mPa and choise 99.22738052 86.0891901 mPa the correct

Equ-3.4.8.1 (3) N>s2 305.2144862 90.7931949 mPa 241.9227025 90.4440715 mPa 86+ P18 (101.45W

# 3.4.8.10 Compression flat

plates

Webb plates

H/t See3.4.22

89.5

**S1** 

23.13644439

**S2** 

39.37218

Equ-3.4.17 (1) N<s1

163.4

mPa

Equ-3.4.17 (2) s1<n<s 37.53949441 Equ-3.4.17 (3) N>s2 47.09368938

mPa

mPa

Flange

H/t See3.4.17

27

**S1** 

23.13644439

**S2** 

39.37218

Equ-3.4.17 (1) N<s1

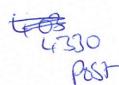
163.4

Equ-3.4.17 (2) s1<n<s 139.5847376 >

mPa mPa

Equ-3.4.17 (3) N>s2 156.1068592

mPa



# AS1664.1:1997-Aluminimum Structures Part 2: limit state design

			Tens	ion	Comp	ressior		Sh	ear			Bea	aring		Mod	ulus of E
Alloy and tamper	Product	Ftu	1	Fty	Fcy		Fsu		Fsy		Fbu		Fby		E	
6063 T6	Extrusions	135	207	172	2	172		131		96		434		276		70000
						180										

Table 3.3(D) Page 20

Member

	ntercept		Slope	lr	ntersection
Вс	190.112849	Dc	0.99075936	Cc	78.6732591
Вр	216.080333	Dp	1.20053227	Ср	73.7947145
Bt	209.620466	Dt	6.71428412	Ct	trial and error
Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674
Btb	329.59479	Dtb	142.532382	Ctb	0.78029952
Bs	120.834478	Ds	0.50203881	Cs	98.6818859
k1	0.35	k2	2 27		
	Bc  Bp  Bt	Bc	Bc	Slope   Slope   Bc	Intercept   Slope   In

Table 3.4	(1)	Dago	21
Table 3.4	A	Page	21

Factor of safety	Normal buildings
фу	0.95
φu	0.85
φνρ	0.9
φb	0.85
фср	0.8
φw	0.9
фс	0.85
φν	0.8
фсс	see below

Table 3.4 (b) Page 21

RHS/SHS section properties

Effective Length (m)

2750 mm between restraints

Height

150 mm

Width

95 mm

Walls side (avg if complex shape)

1.6 mm

Walls top/bottom (average is complex

shape)

4.4 mm

CM (CANTAPORT)

5636200

563.62

ly	1732300	173.23
J (Torsion constant		
(warp))	3296000	329.6
Zx	75150	75.15
Zy	36470	36.47
Area	1390	13.9
Radius of gyration		
Rx	63.67746967 mm	
Radius of gyration		
Ry	35.30239358 mm	

# Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 172.9762669

Zc 75150 Assumed to be Zx

\$1 1.792654179 \$2 2417.766287 mpa

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<: 143.8744269 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 1326.486522 mPa

# MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 25.25544602 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 25.25544602 Rye 108.887406

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1=1

ky 1 rye 108.8874058 S1 -2.570688695 S2 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 143.8719558 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 1326.116668 mPa

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 88.25 141.2 38.36639146 51 90.53212769 52

Equ-3.4.22(1): N<S1 190.06

Equ-3.4.22(2): S1<N<! 138.1632744 Add tripple to one formula

Equ-3.4.22(3): S2>N 138.1670424

38.16+ 75,150

#### FLANGE

Add tripple to one formula

Red through

and choise

the correct

one.

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

20.86363636 Limit (N) (b/t) Н

12.41378457 **S1** 

52 56.24597143

163.4 mPa Equ-3.4.17(1): N<S1 Equ-3.4.17(2): S1<N<! 149.6037251 mPa Equ-3.4.17(3): S2>N 202.0206414 mPa

# Compression capacity

# 3.4.8.1-Genreal compression

62.79993051 Dc **S1** 0.581870399 1.241183988 52 0.681327501 λx 1.22895948 λγ X-X

0.856921225 0.74191851 φcc limits λ<1.2 0.67538585 0.75205433 φcc limits λ>1.2

> Y-Y X-X

Equ-3.4.8.1 (1) N<s1 131.5986167 113.937485 mPa

103.7199698 115.494057 mPa Equ-3.4.8.1 (2) s1<n<: 126.2463732 83.7880321 mPa

99.50157799 84.9327134 mPa Equ-3.4.8.1 (3) N>s2 317.5100739 84.4908199 mPa

1

250.2468196 85.6451025 mPa

gu 93+ 1500

#### 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22 88.25

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 39.58039927 mPa Equ-3.4.17 (3) N>s2 47.7607388 mPa

Flange

H/t See3.4.17 20.86363636

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 149.6037251 mPa Equ-3.4.17 (3) N>s2 202.0206414 mPa

4333 Bean

#### AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Member	beam
T only	

	Product		Tension		Compression She		ear Be		earing		Mod	ulus of E			
Alloy and tamper		Ftu		Fty		Fcy	Fsu		Fsy		Fbu	Fby		E	
6063 T6	Extrusions		207		172	172		131		96	43	4	276		70000
						180									

Table 3.3(D) Page 20

T5,T6,T7,T8 & T9 only							
Type of member stress		Intercept		Slope	Intersection		
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591	
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145	
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error	
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674	
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952	
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859	
Ultimate strength of flat plates in compression							
Ultimate strength of flat plates in bending	k1	0.35		2.27			

Table 3.4	(A)	Page	21
-----------	-----	------	----

Factor of safety	Normal buildings
φγ	0.95
φu	0.85
φνρ	0.9
φb	0.85
фср	0.8
φw	0.9
φς	0.85
φν	0.8
фсс	see below

**RHS/SHS** section properties

Effective Length (m)

3300 mm between restraints

Height Width

124 mm

67 mm

Walls side (avg if complex shape)

1.5 mm

Walls top/bottom (average is complex

shape)

lx

2.2 mm 1873900

CM (CANTAPORT)

187.39

Table 3.4 (b) Page 21

kt	1
kc	1.12

ly	538500	53.85
J (Torsion constant		
(warp))	1147000	114.7
Zx	30220	30.22
Zy	16070	16.07
Area	775	7.75
Radius of gyration		
Rx	49.1725074 mm	
Radius of gyration		
Ry	26.35979343 mm	

# Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 253.7837631

Zc 30220 Assumed to be Zx

\$1 1.792654179 \$2 2417.766287

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<! 140.1305206 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 904.1188606 mPa

### MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

imts (N) 30.63602915 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 30.63602915 Rye 107.71631

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky < 1 = 1

ky 1 rye 107.7163096

S1 -2.570688695 S2 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 140.0959278 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 901.2118034 mPa

26.7 + 3022°

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

**WEBB** 

# NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t)

79.73333333 119.6

51

38.36639146

S2

90.53212769

Equ-3.4.22(1): N<S1

190.06

Equ-3.4.22(2): S1<N<! 150.841182

Add tripple to one formula

Equ-3.4.22(3): S2>N 152.9252696

#### **FLANGE**

#### 3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t)

29.09090909

**S1** 

Add tripple to one formula 12.41378457

1

S2

56.24597143

Equ-3.4.17(1): N<S1

163.4 mPa

Equ-3.4.17(2): S1<N<: 136.1708604 mPa Equ-3.4.17(3): S2>N 144.8866787 mPa

# Compression capacity

# 3.4.8.1-Genreal

compression

Dc 62.79993051 **S1** 0.581870399 **S2** 1.241183988 λx 1.058767516 λγ 1.975063031 у-у 0.777658822 0.58523676

φcc limits λ<1.2 φcc limits λ>1.2 0.728227452 0.85650882

> Y-Y X-X

Equ-3.4.8.1 (1) N<s1 119.4261762 89.8756458 mPa

111.8349302 131.535284 mPa

Equ-3.4.8.1 (2) s1<n<: 96.13598985 38.6718765 mPa 90.02516915 56.5972707 mPa

Equ-3.4.8.1 (3) N>s2 119.3208486 25.8046591 mPa 111.7362976 37.7657721 mPa

Red through

and choise the correct one.

38.67

# 3.4.8.10

#### Compression flat

plates

Webb plates

H/t See3.4.22

79.73333333

**S1** 

23.13644439

S2

39.37218

Equ-3.4.17 (1) N<s1

163.4

Equ-3.4.17 (2) s1<n<s 53.48576441 Equ-3.4.17 (3) N>s2 52.86227257 mPa mPa mPa

Flange

H/t See3.4.17

29.09090909

S1

23.13644439

163.4

**S2** 

39.37218

Equ-3.4.17 (1) N<s1

mPa

Equ-3.4.17 (2) s1<n<s 136.1708604

mPa

Equ-3.4.17 (3) N>s2 144.8866787

mPa



2. 5,000 SERIES

Can'm 3:0 Post 2760.

# STATIC REPORT

PJR—series
\_\_\_\_\_\_5030-H23

#### 1. Material and Evaluation

#### (1)Post

Materi A6063S-T6(SS)

Material performance

Material	Cross-section area	Second sect	tion moment	Section	factor	Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8389	15.92	662.16	188.59	88.29	39.70	70000	3.44	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb + \sigma c/fc =$ 

0.60 < 1.0 OK!

Wind blow up

 $\sigma b/fb + \sigma c/fc =$ 

0.61 < 1.0 OK!

Wind blow down

 $\sigma b/fb + \sigma t/ft =$ 

0.68 < 1.0 OK!

2 · lk/i=

118.5 < 140 OK!

#### 2Beam

Materi A6063S-T6(SS)

Material performance

		Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8393	9.06	231.70	60.75	37.37	18.13	70000	2.59	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb=$ 

0.81 < 1.0 OK!

Wind blow up

 $\sigma$ bx/fbx=

0.60 < 1.0 OK!

Wind blow down

 $\sigma bx/fbx=$ 

0.80 < 1.0 OK!

# 3 Main frame

Materi A6063S-T6(SS)

Material performance

ai performano	se							
	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8579有	1.75	5.80	2.13	2.51	0.93	70000	1.10	180

Material evaluation

 $\sigma b/fb=$ 

0.49 < 1.0 OK!

# 4Front frame

Materi A6063S-T5

Material performance

		Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
-	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
Ī	DE8401	2.55	12.50	6.91	3.81	2.20	70000	1.65	132

Material evaluation

 $\sigma b/fb=$ 

0.25 < 1.0 OK!

# **5**Rear frame

Materi A6063S-T5

Material performance

J1 10	a periormano	00							
		Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
	DF8404有	2.55	7.70	5.90	2.34	1.82	70000	1.52	132

Material evaluation

 $\sigma b/fb=$ 

0.35 < 1.0 OK!

#### (6)Rafter

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Waterial	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8654+DE8666	1.88	0.36	3.75	0.53	1.48	70000	1.41	132

Material evaluation

 $\sigma b/fb=$ 

0.47 <1.0 OK!

7Side frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8683+DE8412	1.65	0.40	2.00	0.32	0.93	70000	1.10	

Material evaluation

 $\sigma b/fb=$ 

0.33 < 1.0 OK!

#### **®**Corner bracket

Materi SPFH590

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	ly(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8064	8.58	205.21	65.07	28.12	20.34	210000	2.75	420

Material evaluation (without support and side panel Vex=38m/s)

 $\sigma$  bx/fb=

0.60 < 1.0 OK!

 $\sigma$  by/fb=

0.08 < 1.0 OK!

# 9Main frame connecting parts

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section factor		Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8086	2.77	5.59	1.85	2.87	1.69	70000	0.82	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

# **®**Front frame connecting parts

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
matorial	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8084	2.62	6.94	4.75	2.95	2.26	70000	1,35	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

# 11)Rear frame connecting parts

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
- material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8085	1.92	2.92	1.83	1.78	1.40	70000	0.98	132

Material evaluation

T /fs=

0.01 < 1.0 OK!

12Roof material

Material

polycarbonat

 $\max \sigma x =$ 

Material performance

110	ii periormani	JC						
ſ		Thickness	Length(short part)	Length(long part)	Inserting	Poisson ratio	Elasticity factor	F value
	Material	cm	cm	cm	cm	ν	kgf/cm2	kgf/cm2
İ	GB4107	0.18	70.3	296.2	1.89	0.3	21000	551

Material evaluation

Bending volume : Wmax=

1.82 cm

44.44 kgf/cm<sup>2</sup>

551.0 kgf/cm<sup>2</sup>

∴ok!

Necessary depth of insert  $\Delta L$ 

< 0.31 cm depth or

1.89 cm

∴ok!

13Roof retainer

Materi A6063S-T5

Material performance

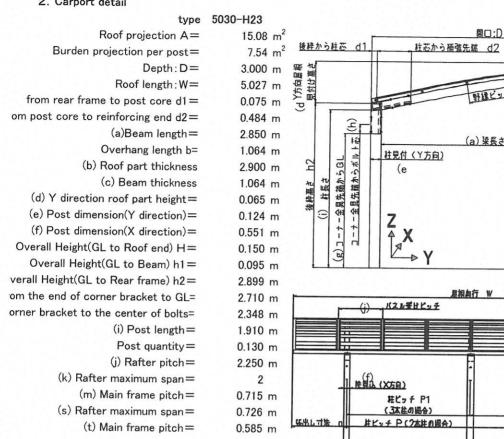
	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8411	0.79	0.03	1.84	0.08	0.72	70000	1.52	132

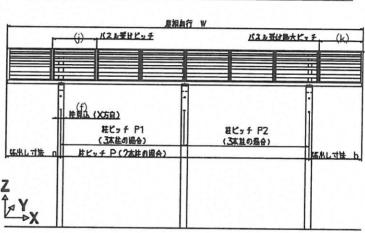
Material evaluation

 $\sigma b/fb=$ 

0.18 < 1.0 OK!

# 2. Carport detail





間口:D

屋根見付け高さ

日で高 屋根高さ h′

#### 3. Load design

1) Vertical over load (G)

Part Weight

Roof 60.0 N/m<sup>2</sup>
Post 42.1 N/m

2)Snow over load

Post quantity	Snow area	Snow quantity	Unit weight	Short period snow period
2 posts type	General area	20 cm	30 N/m²/cm	600 N/m <sup>2</sup>

# ③ Wind blowing load(Vex=38m/s)

· For design of structure frame

Speed pressureq=0.  $6E(\text{Vex} \cdot \text{y})^2 = 708 \text{ N/m}^2$ Standard wind speedVex= 38 m/s  $E = Er^2Gf = 1.194$   $Er = 1. 7 (Zb / Z_G)^{\alpha} = 0.691$ Ground surface Div. Gust influence factor Gf = 2.5 Zb = 5

 $Z_{G} = 450$   $\alpha = 0.2$ 

Installation period factor y= 0.827

·For roof material design

Average speed pressureq' = 0.  $6\text{Er2}(\text{Vex-y})^2$  = 283 N/m<sup>2</sup>

4 Earthquake power

Earthquake power Qi=Z·Rt·Ai·Co·Wi

Area factorZ= 1.0

Vibration feature Rt= 1.0

Coat shear power distribution factorAi= 1.0

Standard shear power factorCo = 0.3

# 4. Preparing calculation

# 4-1 Carport load (For earthquake power calculation)

Earthquake power Qi=Z·Rt·Ai·Co·Wi=

164.2 N

# 4-2 Wind pressure power calculation (Maximum wind power pressure for 1 post)

· For design of structure frame

Wind factor

Independent shed

10°

C=

0.60 (+pressure)

-1.00 (-pressure)

1.2 (Post flat power, side panel)

Wind pressureW=q C=

425 N/m<sup>2</sup>

(Wind blow down)

 $-708 \text{ N/m}^2$ 

(Wind blow up)

849 N/m<sup>2</sup>

(Flat)

# ·Roof material design

Peak with factor calculation process Gpe=

3.1 (+pressure)

3.0 (-pressure: panel center part)

4.0 (-pressure: panel surrounding part)

Peak wind factor Cf=

3.1 0.60 х =

1.86 -3.00

3.0 X -1.004.0 -1.00х

-4.00

Wind pressure W=q' Cf=

527 N/m<sup>2</sup>

(Wind blow down)

=

 $-849 \text{ N/m}^2$ 

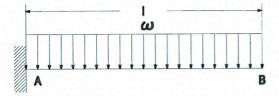
(Wind blow up)

-1132 N/m<sup>2</sup>

(Wind blow up)

#### 5. Beam material examination

# 5-1 Beam load(without support Vex=38m/s)

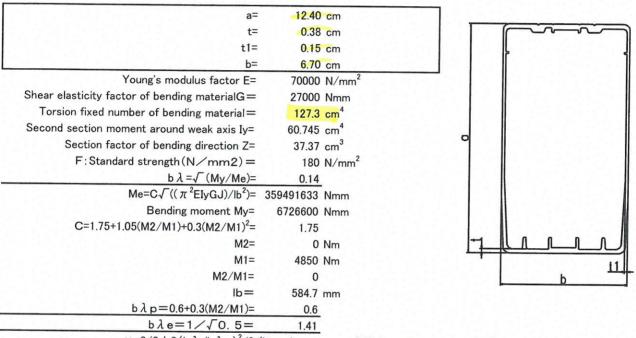


#### Load chart

Type			
Vertical load width (m)	Total/post o	uantity	2.514
I (m)	D-d1-d		2.441
Load	Long period		150.8
ω(N/m)	Short period		1658.9
	Short period blowi	ng down(vertical)	1218.1
	Short period blowi	ng up(vertical)	-1628.1
	Short period blowi	133.8	
	Short period earth	quake(vertical)	150.8
	Short period earth	45.2	
	Long period	load	449.3
	Short period	load	4942.3
Bending moment	Short period blowi	3629.1	
M(N·m)	Short period blowi	-4850.4	
	Short period blowi	ng (horizontal)	398.5
	Short period earth	quake(vertical)	449.3
	Short period earth	nquake(horizontal)	134.8
Maximum bending mon	maxMx	(long period)	
(N·m)		(short period)	4942.3
	maxMy	(long period)	
		(short period)	398.5
Second section mome	Ix(cm⁴)		231.7
	Iy(cm⁴)		60.7
Section factor	Zx(cm <sup>3</sup> )		37.4
	Zy(cm <sup>3</sup> )		18.1
Elasticity factor	E(N/cm <sup>2</sup> )		7000000
Maximum bending stre	maxσx		132.3
(N/mm2)	max σ y	William III	22.0
Vertical maximum defo	max δ x	(cm)	4.54
	max δ x∕I	1/	111
Flat maximum deforma		(cm)	1.40
	max δ y∕l	1/	360

# 5-2 Beam permissible stress degree Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
Ьλ≦Ьλр	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b\lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b\lambda^2) \cdot (F/\nu)$	Long period x 1.5



 $\nu = 3/2 + 2 \left( \frac{b \lambda}{b \lambda} \right)^2 / 3$  (its value assumes 2.17 in case more than 2.17)

 $\nu = 1.51$ 

bλ≦bλp

Permissible stress degree fb:  $F/\nu = 119.5 \text{ N/mm}^2$ 

#### Permissible stress degree at bend parts (strong axis) 1) Frange plate of beam \( \text{top/bottom face} \) $\Gamma$ b :The conversion ratio = b/t $\cdot \sqrt{(F/E)}$ 0.85 Гь = a) Γb ≤ 1.34 fb = F/1.5b) $1.34 < \Gamma b \le 2.69$ $fb = F - 0.248F \Gamma b$ fb = $2.41 \text{ F/}(\Gamma \text{ b}^2)$ c) $2.69 < \Gamma b$ 120.0 N/mm<sup>2</sup> 2) Web plate of beam (side face) $\Gamma d$ : The conversion ratio = $d/t \cdot \sqrt{(F/E)}$ Γd= 3.94 a) $\Gamma d \leq 3.29$ fb = F/1.5b) $3.29 < \Gamma d \le 6.57$ $fb = F - 0.101F\Gamma$ c) $6.57 < \Gamma d$ fb = 14.4 F/( $\Gamma d^2$ ) 108.5 N/mm<sup>2</sup> Therefore, result data is... 108.5 N/mm<sup>2</sup> fbx= 162.7 N/mm<sup>2</sup> fbx= Permissible stress degree at bend parts (weak axis) 1) Frange plate of beam <top/bottom face> $\Gamma b := b/t \cdot \sqrt{(F/E)}$ Гь = 3.94 a) Γb ≦ 1.34 fb = F/1.5 $fb = F - 0.248F \Gamma b$ b) $1.34 < \Gamma b \le 2.69$ c) $2.69 < \Gamma b$ $fb = 2.41 F/(\Gamma b^2)$ 28.0 N/mm<sup>2</sup> 2) Web plate of beam (side face) $\Gamma d$ : The conversion ratio = $d/t \cdot \sqrt{(F/E)}$ Γd= 0.85 a) $\Gamma d \leq 3.29$ fb = F/1.5b) $3.29 < \Gamma d \le 6.57$ $fb = F - 0.101F\Gamma$ fb = $14.4 \, \text{F/}(\, \Gamma \, \text{d}^2)$ c) $6.57 < \Gamma d$ 120.0 N/mm<sup>2</sup> fb= Therefore, result data is... 28.0 N/mm<sup>2</sup> fby= 42.0 N/mm<sup>2</sup> fby= Section of the Beam examination Snow for short period 4942.3 N·m M= $\sigma b =$ 132.3 N/mm<sup>2</sup> 0.81 < 1.0OK! $\sigma b/fb=$ Wind blow down 3629.1 N·m M= 97.1 N/mm<sup>2</sup> $\sigma$ bx= 0.60 < 1.0OK! $\sigma$ bx/fbx= Wind blow up -4850.4 N·m M= 129.8 N/mm<sup>2</sup> $\sigma bx =$ 0.80 < 1.0OK! $\sigma bx/fbx=$ Wind blow horizontal M= 398.5

OK!

22.0 0.52 < 1.0

 $\sigma$  by=

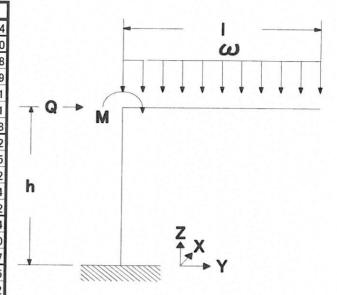
 $\sigma$  by/fby=

# 6. Post material examination

# 6-1 Post load

# Load chart

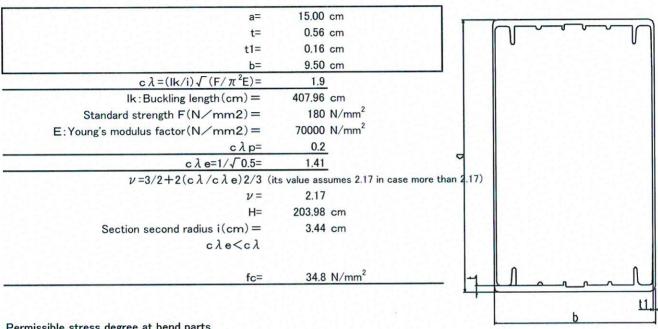
Load Chart		
Туре		
Vertical load width (m)	Total/post quantity	2.51
I (m)	D-d1	2.85
	Long period load	150.
Load	Short period load	1658.9
ω(N/m)	Short period blowing up(vertical)	1218.
	Short period blowing down(vertical)	-1628.
	Short period earthquake(vertical)	150.8
	Long period load	547.2
Axial force	Short period load	5071.5
by vertical load	Short period blowing up(vertical)	3749.2
N(N)	Short period blowing down(vertical)	-4789.4
	Short period earthquake(vertical)	547.2
Flat load	Short period wind X	637.4
Q(N)	Short period wind Y	980.0
	Short period earthquakeX, Y	135.7
	Long period load	612.5
Bending moment	Short period load	6737.2
M(N·m)		4947.2
WIZIV III)	Short period blowing up(vertical)	
	Short period blowing down(vertical)	-6612.0
Bending moment	Short period earthquake(vertical)	612.5
	Short period blowing up(vertical)+WindY	7152.2
by vertical and flat load Mx (N•m)	Short period blowing down(vertical)+WindY	-8817.0
	Short period earthquake(vertical) + Earthqua	1
Bending moment by flat load	Short period windX	1434.2
My (N·m)	Short period earthquakeX	305.4
Maximum bending		<del> </del>
moment(N·m)	maxMx (long period)	
moment(N·m)	(short period)	8817.0
	maxMy (short period wind)	1434.2
0 1 11	(short period earthqua	
Second section moment		662.155
0 11 6 1	Iy(cm4)	188.59
Section factor	Zx(cm3)	88.287
	Zy(cm3)	39.70
Max. bending stress deg.		6.94
$\sigma_{\mathbf{X}}(N/mm2)$	Short period load	76.31
	Short period blowing up(vertical)	56.04
	Short period blowing down(vertical)	-74.89
	Short period earthquake(vertical)	6.94
	Short period blowing up(vertical)+WindY	81.01
	Short period blowing down(vertical)+WindY	-99.87
	Short period earthquake(vertical) + Earthquak	10.40
	Long period	6.94
	Short period(Y direction Vertical load)	99.87
Bending stress degree	Short period windX	36.12
σy(N/mm2)	Short period earthquakeX	7.69



#### 6-2 Post permissible stress degree

Permissible pressure stress degree

remissible pressure stress degree		
	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
cλ≦cλp	F/ <i>v</i>	Long period x 1.5
cλp <cλ≦cλe< td=""><td><math>(1.0-0.5((c\lambda-c\lambda p)/(c\lambda e-c\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></cλ≦cλe<>	$(1.0-0.5((c\lambda-c\lambda p)/(c\lambda e-c\lambda p)))F/\nu$	Long period x 1.5
cλe <cλ< td=""><td><math>(1/c\lambda^2)\cdot (F/\nu)</math></td><td>Long period x 1.5</td></cλ<>	$(1/c\lambda^2)\cdot (F/\nu)$	Long period x 1.5



#### Permissible stress degree at bend parts

# 1) Frange plate of beam <top/bottom face>

 $\Gamma d := d/t \cdot \sqrt{(F/E)}$ 

Γd= 0.83

- a)  $\Gamma d \leq 1.34$
- fb = F/1.5
- b)  $1.34 < \Gamma d \le 2.69$
- $fb = F 0.248F \Gamma d$
- c)  $2.69 < \Gamma d$
- fb = 2.41 F/( $\Gamma d^2$ )

120.0 N/mm<sup>2</sup>

#### 2) Web plate of beam <side face>

 $\Gamma d := d/t \cdot \sqrt{(F/E)}$ 

Γd= 4.40

- a)  $\Gamma d \leq 1.34$
- fb = F/1.5
- b)  $1.34 < \Gamma d \le 2.69$
- $fb = F 0.248F \Gamma d$
- c)  $2.69 < \Gamma d$
- fb = 2.41 F/( $\Gamma d^2$ )

Therefore, result date is ***			7.7.7
	fc=	22.4 N/mm <sup>2</sup>	
	fc=	33.6 N/mm <sup>2</sup>	

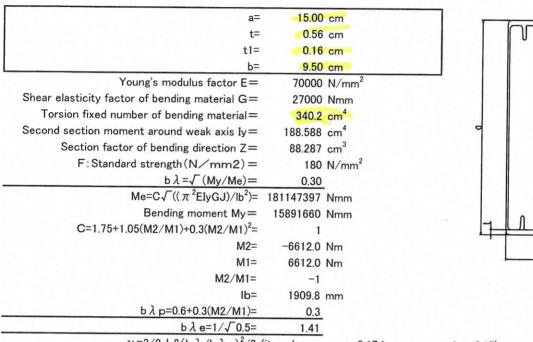
fc=

22.4 N/mm<sup>2</sup>

# 6-3 Permissible stress degree at bend parts

Permissible bending stress degree

Torriding delete degree		
	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
Ьλ≦Ьλр	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td>(1/b λ<sup>2</sup>) • (F/ν)</td><td>Long period x 1.5</td></bλ<>	(1/b λ <sup>2</sup> ) • (F/ν)	Long period x 1.5



 $\nu$  =3/2+2(b  $\lambda$  /b  $\lambda$  e)<sup>2</sup>/3 (its value assumes 2.17 in case more than 2.17)  $\nu$  = 1.53

 $\nu = 1.5$   $b \lambda \leq b \lambda p$ 

Permissble stress degree fb:  $F/\nu = 117.7 \text{ N/mm}^2$ 

#### Permissible bending stress degree (strong axis)

#### 1) Frange plate <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

 $\Gamma b =$ 0.83

a) Γb ≤ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma b$ 

c)  $2.69 < \Gamma b$ 

 $fc = 2.41 F/(\Gamma b2)$ 

fb=

2) Web plate (side face)

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

4.40  $\Gamma d =$ 

a) Γd ≤ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F \Gamma d$ 

c)  $6.57 < \Gamma d$ 

 $fb = 14.4 \, F/(\Gamma d^2)$ 

fb=

Therefore, result date is \*\*\*

100.0 N/mm<sup>2</sup> fbx= fbx= 150.0 N/mm<sup>2</sup>

100.0 N/mm<sup>2</sup>

120.0 N/mm<sup>2</sup>

#### Permissible bending stress degree (weak axis)

#### 1) Frange plate <top/bottom face>

 $\Gamma$ b :The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

4.40  $\Gamma_b =$ 

a) Γb ≤ 1.34

fc =F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

fc = F - 0.248F \(\Gamma\) d

c)  $2.69 < \Gamma b$ 

2.41 F/( \( d2) fc =

> 22.4 N/mm<sup>2</sup> fb=

### 2) Web plate <side face>

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

Γd= 0.83

a) Γd ≦ 3.29

fb =F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

F - 0.101F \( \text{d} \) fb =

c) 6.57 < \Gamma\d

 $14.4 \, \text{F}/(\Gamma \, \text{d}^2)$ fb =

> 120.0 N/mm<sup>2</sup> fb=

Therefore, result date is \*\*\*

22.4 N/mm<sup>2</sup> fby= 33.6 N/mm<sup>2</sup> fby=

# Examination of the section of the post

Short period snow load

76.3 N/mm<sup>2</sup> 3.2 N/mm<sup>2</sup>  $\sigma_{c=N/A=}$ 

0.60 < 1.0OK!  $\sigma b/fb + \sigma c/fc =$ 

Wind blow down

81.0 N/mm<sup>2</sup> σb=  $\sigma_c=N/A=$ 2.4 N/mm<sup>2</sup>

0.61 < 1.0OK!  $\sigma b/fb + \sigma c/fc =$ 

Wind blow up

99.9 N/mm<sup>2</sup> σb= 3.0 N/mm<sup>2</sup>  $\sigma t=N/A=$ 

0.68 < 1.0OK!  $\sigma b/fb + \sigma t/ft =$ 

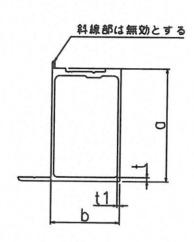
> 118.5 < 140 OK! 2-lk/i=

# 7. Main Frame Bending permissible stress degree

7-1 Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
bλ≦bλp	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda -b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda -b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	4.60 cm
t=	0.11 cm
t1=	0.09 cm
b=	2.50 cm
Young's modulus factor E=	70000 N/mm <sup>2</sup>
Shear elasticity factor of bending materialG=	27000 Nmm
Torsion fixed number of bending material=	3.3 cm <sup>4</sup>
Second section moment around weak axis Iy=	2.126 cm <sup>4</sup>
Section factor of bending direction Z=	2.512 cm <sup>3</sup>
F: Standard strength(N/mm2) =	180 N/mm <sup>2</sup>
b $\lambda = \sqrt{\text{(My/Me)}}$	0.28
Me=C $\sqrt{((\pi 2EIyGJ)/lb2)}$ =	5684039 Nmm
Bending moment My=	452160 Nmm
C=	1.13
lb=	715 mm
$b \lambda p = 0.6 + 0.3 (M2/M1) =$	0.3
b λ e=1/√0.5=	1.41



 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)  $\nu =$ 1.53

0.41

120.0 N/mm<sup>2</sup>

Ьλ≦Ьλр

117.9 N/mm<sup>2</sup> fb=

#### Permissible stress degree at bend parts

# 1) Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

Гь =

a) Γb ≤ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c) 0.876 <  $\Gamma b$ 

fb =  $0.256 \, \text{F/}(\Gamma \, \text{b}^2)$ 

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

1.07

fb=

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c)  $2.69 < \Gamma b$ 

 $fc = 2.41 F/(\Gamma d2)$ 

fb= 120.0 N/mm<sup>2</sup>

# 2) Wave plate of beam <side face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

2.47

a) Γd ≤ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

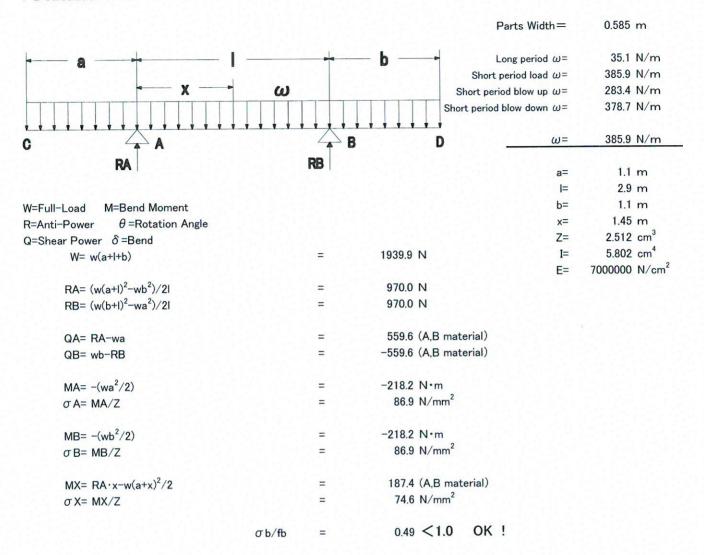
fb =  $14.4 \, \text{F}/(\Gamma \, \text{d}^2)$ 

120.0 N/mm<sup>2</sup> fb=

Therefore, result data is...

fb= 117.9 N/mm<sup>2</sup> fb= 176.9 N/mm<sup>2</sup>

# 7-2 Calculation of Main Frame Section

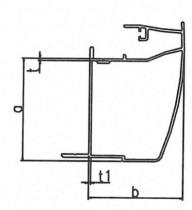


# 8. Front frame bending permissible stress degree

8-1 Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
ьλ≦ьλр	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	4.77	cm	
t=	0.10	cm	
t1=	0.10	cm	
b=	4.20	cm	
Young's modulus factor E=	70000	N/mm <sup>2</sup>	
Shear elasticity factor of bending materialG=	27000	Nmm(アルミ材)	
Torsion fixed number of bending material=	8.4	cm <sup>4</sup>	
Second section moment around weak axis Iy=	6.911	cm <sup>4</sup>	
Section factor of bending direction Z=	3.805	cm <sup>3</sup>	
F: Standard strength(N/mm2) =	132	N/mm <sup>2</sup>	
b $\lambda = \sqrt{\text{(My/Me)}}$	0.17		
Me=C $\sqrt{((\pi 2EIyGJ)/lb2)}$ =	16407392	Nmm	
Bending moment My=	502260	Nmm	
C=	1.13		
lb=	715	mm	
b $\lambda$ p=0.6+0.3(M2/M1)=	0.3		
b 2 o-1/ [0.5-	1.41		



 $\frac{\text{b }\lambda \text{ e}=1/\sqrt{0.5}=}{\nu=3/2+2(\text{b }\lambda/\text{b }\lambda\text{ e})^2/3\text{ (its value assumes 2.17 in case more than 2.17)}}$ 

 $\nu = 1.51$ 

bλ≦bλp

fb= 87.4 N/mm<sup>2</sup>

# Permissible stress degree at bend parts

# 1) Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

Γb = 1.74

a) Гb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c) 2.69 <  $\Gamma$ b

fc =  $2.41 \text{ F/(}\Gamma \text{ d2)}$ 

fb= 75.1 N/mm<sup>2</sup>

# 2) Web plate of beam <side face>

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 1.98$ 

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c) 6.57 <  $\Gamma d$ 

 $fb = 14.4 \, F/(\Gamma d^2)$ 

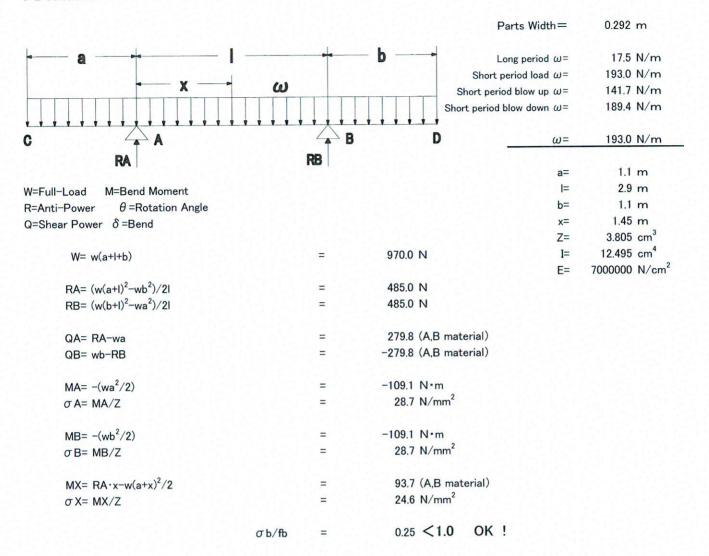
Therefore, result data is...

fb= 75.1 N/mm<sup>2</sup> fb= 112.7 N/mm<sup>2</sup>

fb=

88.0 N/mm<sup>2</sup>

#### 8-2 Calculation of Front Frame Section



# 9. Bending permissible stress degree at rear frame

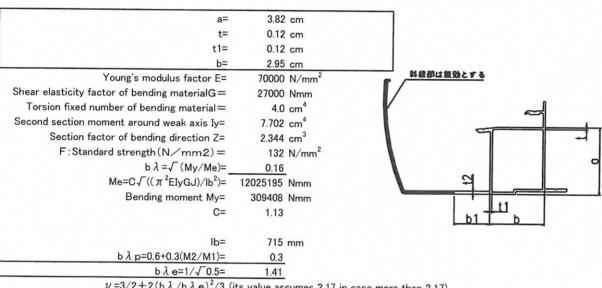
#### 9-1 Calculation method of effective section

 $\Gamma b = b/t \cdot \sqrt{(F/E)} = 0.438$ Therefore...  $b/t = 0.438/\sqrt{(F/E)} = 10.09$ Effective Depth t2= 1.70 mm b1= 17.15 mm

9-2. Bending permissible stress degree at rear frame

Randing parmiagible atures des

bending permissible stress degre	ree				
	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)			
Ьλ≦Ьλр	F/ν	Long period x 1.5			
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5			
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5			



 $\nu = 3/2 + 2(b \lambda /b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

Ьλ≦Ьλр

87.5 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

#### 1) Frange plate of beam (top/bottom face)

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Гь = 0.98

a)  $\Gamma b \le 1.34$ 

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F\Gamma d$ 

c) 2.69 < \Gamma b

 $fc = 2.41 \, F/(\Gamma d2)$ 

fb= 88.0 N/mm<sup>2</sup>

#### 2) Web plate of beam (side face)

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

Γd= 1.30

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ c) 6.57 < \Gamma\d

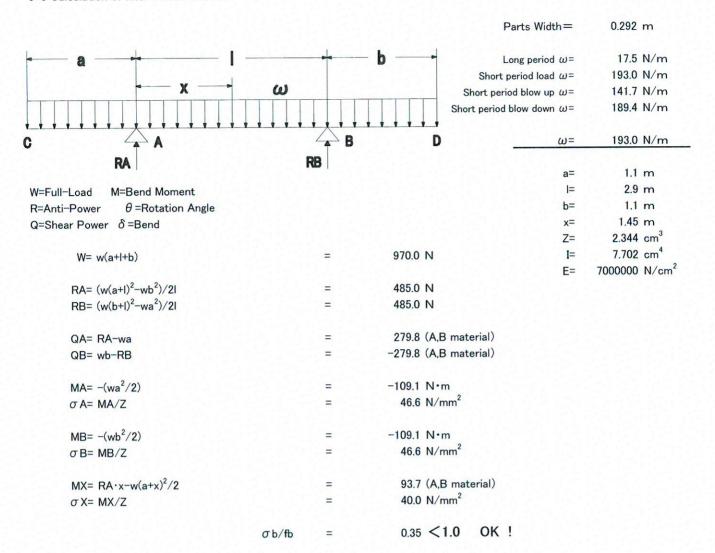
 $fb = F - 0.101F\Gamma$ fb = 14.4 F/( $\Gamma d^2$ )

fb= 88.0 N/mm<sup>2</sup>

Therefore, result data is...

87.5 N/mm<sup>2</sup> fb= 131.2 N/mm<sup>2</sup>

#### 9-3 Calculation of Rear Frame Section

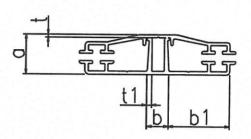


# 10. Rafter / Roof retainer bending permissible stress degree

10-1 Bending permissible stress degree

a=	1.30 cm
t=	0.10 cm
t1=	0.17 cm
b=	0.72 cm
b1=	1.99 cm

Young's modulus factor E=  $70000 \text{ N/mm}^2$ Shear elasticity factor of bending materialG= 27000 NmmSecond section moment around weak axis Iy=  $0.364 \text{ cm}^4$ Section factor of bending direction Z=  $0.529 \text{ cm}^3$ F:Standard strength(N/mm2) =  $132 \text{ N/mm}^2$ 



Therefore...

 $fb = 88.0 \text{ N/mm}^2$ 

# Permissible stress degree at bend parts

# Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

Γb = 0.86

a) Γb ≤ 0.438

fb = F/1.5

b) 0.438 < Γb ≤ 0.876

 $fb = F - 0.760F \Gamma b$ 

c)  $0.876 < \Gamma b$ 

fb =  $0.256 \, \text{F/(} \, \Gamma \, \text{b2)}$ 

45.3 N/mm<sup>2</sup>

fb=

=\_\_\_

				Parts Width=	0.715 m
				=	0.585 m
				14.0 to 20.0 to 20.0 to 20.0 To	0.303 111
-   -	<del> </del>   <del> </del>	- 1 -	+-   -+-	Long period ω=	42.9 N/m
				Short period load ω=	471.9 N/m
				Short period blow up $\omega$ =	346.5 N/m
* * * * * *	* * * * * * * *	* * * *	<del> </del>	Short period blow down $\omega$ =	-463.1 N/m
A 1	B 2 C	3	D 2 E 1	F	
				ω=	471.9 N/m
W=Full-Load	M=Bend Moment			Z=	$0.529 \text{ cm}^3$
R=Anti-Power	$\theta$ =Rotation An	gle			
Q=Shear Pow	er δ=Bend			I=	0.364 cm <sup>4</sup>
	ωι	=	275.9 N		
				E=	7000000 N/cm <sup>2</sup>
RA=	$0.395 * \omega 1$	=	109.0 N		
RB=	$1.131 * \omega 1$	=	312.1 N		
RC=	$0.974 * \omega 1$	=	268.7 N		
RD=	$0.974 * \omega 1$	=	268.7 N		
RE=	$1.131 * \omega 1$	=	312.1 N		
RF=	0.395 * ωI	=	109.0 N		
Rmax=			312.1 N		
MB=	$-0.105 * \omega 1^{2}$	=	-16.9 N•m		
MC=	$-0.079 * \omega 1^{2}$	=	-12.7 N•m		
MD=	$-0.079 * \omega 1^{2}$	=	-12.7 N•m		
ME=	$-0.105 * \omega 1^{2}$	=	-16.9 N•m		
M1=	$0.078 * \omega 1^{2}$	=	12.6 N·m		
M2=	$0.033 * \omega 1^{2}$	=	5.3 N·m		
M3=	0.046 * ωl <sup>2</sup>	=	7.4 N·m		
σ X=	MX/Z	=	32.0 N/mm <sup>2</sup>		
	$\sigma$ b/fb	=	0.47 < 1.0	OK!	

# 11. Side frame bending permissible stress degree

# 11-1 Calculation method of effective section

$$\Gamma$$
 b = b/t·  $\sqrt{(F/E)}$  = 0.438  
b/t = 0.438/ $\sqrt{(F/E)}$  = 10.09

Effective Depth

t2= 1.20 mm b2= 12.10 mm

Therefore...

# 11-2 Bending permissible stress degree

a=	1.30 cm	
t=	0.11 cm	
t1=	0.17 cm	
b=	0.72 cm	
b1=	1.99 cm	

Young's modulus factor E=

70000 N/mm<sup>2</sup>

ear elasticity factor of bending materialG=

27000 Nmm

cond section moment around weak axis Iy=

2 cm<sup>4</sup>

Section factor of bending direction Z=

 $0.324 \text{ cm}^3$ 

F: Standard strength (N/mm2) =

132 N/mm<sup>2</sup>

#### Therefore...

 $fb = 88.0 \text{ N/mm}^2$ 

# Permissible stress degree at bend parts

# Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

Гb =

0.79

53.2 N/mm<sup>2</sup>

a) Γb ≤ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

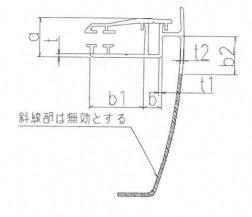
c)  $0.876 < \Gamma b$ 

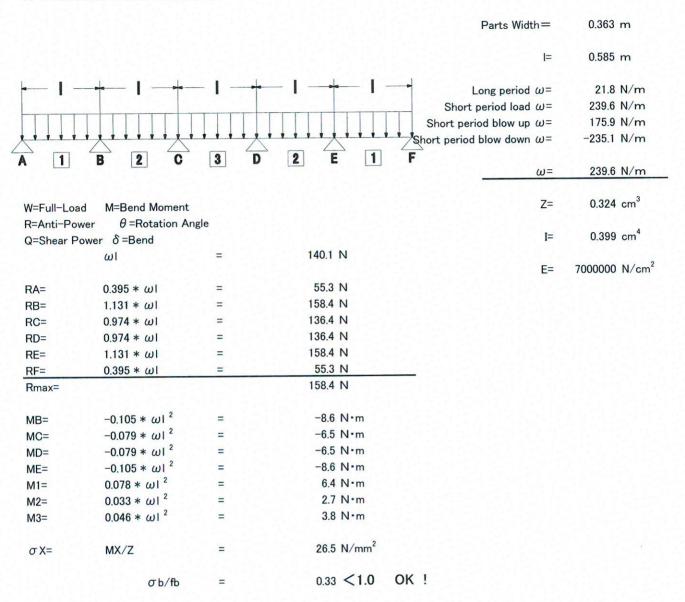
fb =  $0.256 \, \text{F/(} \, \Gamma \, \text{b2)}$ 

Therefore···

fb= 53.2 N/mm<sup>2</sup>
fb= 79.8 N/mm<sup>2</sup>

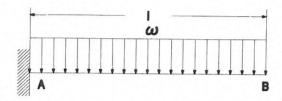
fb=





# 12. Corner bracket examination

# 12-1 Beam load



#### Load chart

Туре			
Vertical load width (m)	Total/post	quantity	2.514
I (m)	D-d1-	2.925	
Load	Long period	150.8	
ω(N/m)	Short perio	d load	1658.9
	Short period blow	wing up(vertical)	1218.1
	Short period blov	wing up(vertical)	-1477.3
	Short period blov	wing down(horizontal)	160.5
	Short period eart	thquake(vertical)	150.8
	Short period eart	hquake(horizontal)	45.2
	Long period	load	645.1
	Short perio	d load	7096.5
Bending moment	Short period blov	ving down(vertical)	5211.0
M(N·m)	Short period blowing up(vertical)		-6319.5
	Short period blowing (horizontal)		686.6
	Short period earthquake(vertical)		645.1
	Short period eart	hquake(horizontal)	193.5
Maximum bending momen	maxMx	(long period)	
(N·m)		(short period)	7096.5
	maxMy	(long period)	
		(short period)	686.6
Second section moment	Ix(cm⁴)		231.7
	Iy(cm⁴)		60.7
Section factor	Zx(cm <sup>3</sup> )		37.4
	Zy(cm <sup>3</sup> )		18.1
Elasticity factor	E(N/cm <sup>2</sup> )		21000000
Maximum bending stress degree	max σ x		189.9
(N/mm2)	max σ y		37.9
	max δ x	(cm)	3.12
	$\max \delta x / I$	1/	161
Flat maximum deformation quantity	max δ y	(cm)	1.15
	max δ y∕l	1/	437

# 12-2 Calculation of Corner bracket Section

Material	Second sec	tion moment	Section	factor
	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)
GB8064	205.211	65.073	28.119	20.335

fb= 420 N/mm<sup>2</sup> Mx= 7096.5 N·m My= 686.6 N·m

 $\sigma$  bx= 252.4 N/mm<sup>2</sup>  $\sigma$  by= 33.8 N/mm<sup>2</sup>

 $\begin{array}{lll} \sigma\,\mbox{bx/fb=} & 0.60 < 1.0 & \mbox{OK !} \\ \sigma\,\mbox{by/fb=} & 0.08 < 1.0 & \mbox{OK !} \end{array}$ 

# 13. Examination of main frame connecting part

#### 13-1 Calculation of Load

· Anti-Power of rafter



P1=

312.1 N

156.0 N

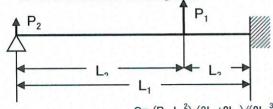
←from "Calculation of rafter"

\*Anti-Power of connecting rafter

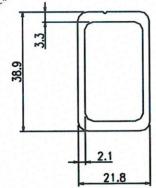
P2=

←(Anti-Power of rafter)/2





L <sub>1</sub> (m)	1.06
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.35
A(mm <sup>2</sup> )	276.8
fs(N/mm <sup>2</sup> )	76.2



 $Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + I_3$ 

Q=

200.8 N

τ =Q/A=

0.73 N/mm<sup>2</sup>

0.01 < 1.0

OK!

## 14. Examination of front frame connecting part

#### 14-1 Calculation of Load

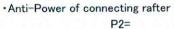
· Anti-Power of rafter

P<sub>1</sub>=

P1=

109.0 N

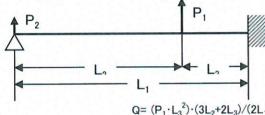
←from "Calculation of rafter"



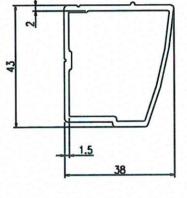
54.5 N

←(Anti-Power of rafter)/2

#### 14-2 Examination of shearing force



1.06
0.715
0.35
261.6
76.2



$$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_3$$

70.1 N

 $\tau = Q/A =$ 

0.27 N/mm<sup>2</sup>

T /fs=

0.01 < 1.0 OK!

# 15. Examination of gutter connecting part

# 15-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

P1=

109.0 N

←from "Calculation of rafter"

· Anti-Power of connecting rafter

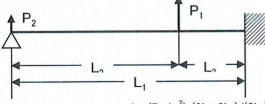
P<sub>2</sub>=

P2=

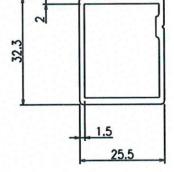
54.5 N

←(Anti-Power of rafter)/2

#### 15-2 Examination of shearing force



L <sub>1</sub> (m)	1.06
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.35
A(mm <sup>2</sup> )	192.1
fs(N/mm <sup>2</sup> )	76.2



 $Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_3$ 

Q=

70.1 N

 $\tau = Q/A =$ 

0.37 N/mm<sup>2</sup>

T/fs=

0.01 < 1.0

OK!

## 16. Examination of main frame and beam connection

#### 16-1 Examination of screw pull-out force

·Pull-out force/screw

T= 485.0 N

·Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $172.7 \text{ N/mm}^2$ 

· Effective section

A=

11.2 mm<sup>2</sup>

σt=

43.2 N/mm<sup>2</sup>

 $\sigma t/ft=$ 

0.25 < 1.0 OK!

β	0.6
Screw diameter	5
Core diameter	3.78
Pitch	0.8
t(Thickness)	4.6
Ft(Standard strength)	100

# 16-2 Examination of Beam bending stress

·Beam top face bending moment

M= 2721.1 N·mm Z= 58.6 mm<sup>3</sup>

σb=

46.5 N/mm<sup>2</sup>

 $\sigma b/fb=$ 

0.22 < 1.0OK!

#### b (Beam depth dimension) 61 t(Thickness) 2.4 a (load point) 18.5

## 17. Examination of rafter and main frame connection

# 17-1 Examination of screw pull-out force

·Pull-out force/screw

T=

312.1 N

·Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$

93.7 N/mm<sup>2</sup>

Effective section

A=

6.7 mm<sup>2</sup>

 $\sigma t =$  $\sigma t/ft=$  46.3 N/mm<sup>2</sup>

0.49 < 1.0

OK!

0.6 Screw diameter 4 Core diameter 2.93 Pitch 0.7 t(Thickness) 2.1 Ft (Standard strength) 100

# 17-2 Examination of Main frame bending stress

· Main frame top face bending moment

M=

898.7 N·mm

Z=

22.0 mm<sup>3</sup>

 $\sigma b =$ 

40.8 N/mm<sup>2</sup>

 $\sigma b/fb=$ 

0.20 < 1.0 OK!

b (Beam depth dimension)	25
t(Thickness) center	2.3
a (load point)	10

#### 18. Examination of Roof material

#### 18-1 Examination of Bending volume

Poisson ratio : $\nu =$	0.3	Bending volume: Wmax
Distribution Load : P=	$0.0116 \text{ kgf/cm}^2$	A·Wmax³+B·Wmax+C=0
E:Young's modulus factor =	$21000 \text{ kgf/cm}^2$	
Thickness:h=	0.18 cm	$A = (4 \nu /a^2 b^2 + (3 - \nu^2) \cdot (1/a^4 + 1/b^4))/h^3$
Short edge a=	70.3 cm	= 2096.9
Long edge b=	296.2 cm	$B = (4/3) \cdot (1/a^2 + 1/b^2)^2 / h$
		= 33.8
		$C = -256(1 - \nu^2)P/(\pi^6Eh^4)$
		= -12701.0

Bending volume : Wmax=

1.82 cm

#### 18-2 Bending stress degree

$$\max \sigma x = ((\pi^2 \cdot E \cdot W_{max})/(8 \cdot (1 - \nu^2))) \cdot ((2 - \nu^2) W_{max} + 4h)/a^{2+} (\nu (W_{max} + 4h))/b2)$$

$$= 44.4 \text{ kgf/cm}^2 < 551 \text{ kgf/cm}^2 \cdot OK!$$

#### 18-3 Necessary depth of insert

Necessary depth of insert  $\Delta L$ 

 $\Delta L = \Delta X \times SF + \Delta I$ 

However,  $\Delta X$ : The gap volume by a bend

= (lx - b)/2

Ix : Arc length while bending

=  $2 \times \sin(-1((b/2)/r) \times r$ 

r: Radius rate while bending

 $= (b2+4\delta 2)/8\delta$ 

 $\delta$ : Bending rate of Polycarbonate = Wmax (cm)

b: Length of short (cm)

ΔI: The volume of expansion and contraction at temperature

 $= K \cdot \Delta t \cdot b/2$ 

K : Line coefficient of expansion (cm/cm/°C)

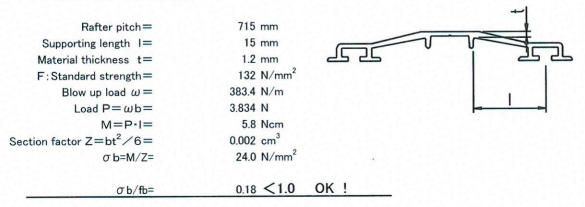
 $\Delta t$  : Temperature differency at  $50^{\circ}\!\text{C}$ 

SF: Safety ratio SF=3. 0

Therefore···

∆L= 0.31 cm depth or more < 1.89 cm ∴OK!

#### 19. Examination of Roof retainer



# 20. Ground Foundation

Resistance moment  $M_R{=}(N{+}W)\times e{+}q{'}s\times b\times h_1\times (h_1{+}h_0)$ 20-1 Without concrete floor

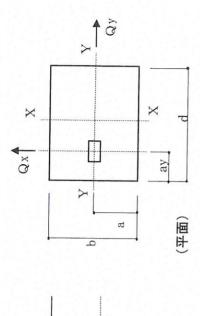
Resistance moment

 $M=M' +Q*(h/2)-N \times (d/2-a)$ 

0 Base Foundation Lateral Pressure

ф ф ау ах ах Endurance strength of ground Fe= No line concrete Volume weight Short Term Permissible Endurance strength of ground q=

h/2	2	II	2	ТП	1		1	(外野田)	
	52	0.90 m	1.20 m	0.55 m	0.30 m	0.45 m	100 KN/m <sup>2</sup>	200 KN/m <sup>2</sup>	22.5 KN/m <sup>3</sup>



Zø

M

P + + 4

	Spindle Force(N)	Shear power(N)	ver(N)	Moment(Nm)	nt(Nm)		Foundation size(m)	size(m)		Base Weight	Endurance strength of	Lateral Pressure
	z	ŏ	ĝ	×	ν,'Μ	2	7	4		,,,,,,,		
Long period load	6 2 7 2	00	00	2010	ı	1	1		в	N(N)	q'(kN/m2)	s(kN/m2)=0.5c
-	7.1.0	0.0	0.0	0.710	0.0	0.90	1.20	0.55	030	13.365	100	0.03
Short period load	50/1.5	0.0	0.0	6737.2	00	060	1 20	22.0	000	0 0	001	0.00
Short term earthquake X	5472	1357	00	2012	V 300	0000	07.	0.00	0.30	13,365	200	100.00
Chort torm cathering	1 1 1		2 1	0.210	9000	0.90	1.20	0.55	0.30	13,365	200	1000
Olor Cerri ear triduake 1	7.740	0.0	135./	917.9	0.0	060	120	ממ	000	1000	0000	0.00
Short period blow down + Holizontal	37492	6374	00	0 4017 0	0 7 0 7 7	000	2	0.00	0.00	13,300	200	100.00
Short period blow down + Holis	27402		0.00	7.7464	1434.2	0.90	1.20	0.55	0.30	13,365	200	1000
Charles being blow down - Hollzolltal	7.64/0	0.0	980.0	7.757.7	0.0	06.0	1.20	0.55	030	12 265	000	200
Short period blow up+Holizontal X	-4789.4	637.4	0.0	-66120	1434 2	000	1 20	000	00.0	000,01	007	100.0
Short period blow un+Holizontal Y	-4789 A	00	0000	000	1:00	0.0	07.1	0.00	0.30	13,365	200	100.0
	1,00.1	0.0	200.0	0./188-	0.0	0.90	1.20	0.55	0.30	13,365	200	1000
											201	0.00

subsidence load		Endurance strength of ground	
(N) M+N	1	(N) b×p×q	
18437	/	216000	. OK !

(dn wold poi			. ok !
Examination of uplift (short period blow up)	Base weight	bxdxhx y(N)	13365
Examination of	uplift load	(N) N	4789

				X direction	ion			
	t(m)	e(m)	h0(m)	h1(m)	Resistance MRx	Fall Mx		TIDOMENT
	$(N+M)/(p \times d)$	(d-t)/2	Qv/(b×a's)	(h-h0)/2	MRv(N·m)	Mc(Ni.m)	MA. AMD.	OCCUME!
	1 1 7 0			1 1/2	AIII AII WALLET	(III - NI) YIAI	MX/MRX	N N N
Long period load	0.155	0.523	0.000	0.275	10,675	448.3	0.042	0.042 < 1.0 OK
Short period load	0.102	0.549	0.000	0.275	16.924	52158	0.308	
Short term earthquake X	7200	0.561	0000	0.275		448.3	0.000	2 0
Short term earthquake Y	0.077	0.561	0.002	0.274		7910	0.050	2.0
Short period blow down + Holizontal X	0.095	0.552	0000	0.275		3822.4	1000	0.1
Short period blow down + Holizontal Y	0.095	0.552	0.011	0.270		62060	1000	0.1
Short period blow up+Holizontal X	0.048	0.576	0000	0.275		0.050.9	0.387	0.1
Short period blow wold being the	0700	9230	2000	0.2.0		7.6/16-	0.441	<1.0 OK
The state of the s	0.040	0/00	110.0	0.270	11,745	-7649.7	0.651	<1.0 OK
				Y direction	on			
	t(m)	e(m)	h0(m)	h1(m)	Resistance MRx	Fall My		a Lind of II
	(,b x p)/(M+N)	(b-t)/2	Ox/(d×n's)	(h-h()/2	MD.(NI.E.)	NA. (NI.		OODGINEIN
Short term earthquist X	0 0 0 0	1010	1000	7//011 11)	NIN VIN	MIX(M·m)	My/Mry	MR≧M
and colling and cold days a	0.000	0.421	100.0	0.274	14,932	342.7	0.023 < 1.0	<1.0 OK
Short period blow down + Holizontal X	1/0.0	0.414	0.005	0.272	16,165	1609.5	0.100 < 1.0	
Short period blow up+Holizontal X	0.036	0.432	0.005	0.272	12.780	1609 5	0.126 / 10	

~	
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21–1 With concrete floor Resistance moment  $M_R=(N+W)\times e+q^*s\times b\times h_1\times h_1/2$ 

Fall moment

M=M' +Q\*(h/2)

Base Foundation

(i) (ii) (iii)	
Lateral Pressure	0.5
=q	0.60 m
=p	0.45 m
=4	0.55 m
h <sub>1</sub> =	0.45 m
<u>II</u>	0.35 m
Concrete floor thickness t=	0.10 m
Endurance strength of ground Fe=	50 KN/m <sup>2</sup>
Short Term Permissible Endurance strength of ground q=	100 KN/m <sup>2</sup>
No line concrete Volume weight $\gamma$ =	22.5 KN/m <sup>3</sup>
Concrete standard strength Fc=	15000 KN/m <sup>3</sup>

		, o'
<b> </b>	<b>⋈</b>	
	<b>^ ^ ^ ^ ^ ^ ^ ^ ^ ^</b>	11.
	<u> </u>	(上) (国州人)

		Y Qy		(国本)
Q <sub>x</sub>	X		X	P
		A A		1: 綠端距離

Spindle Force(N)	Shear power(N)	er(N)	Moment(Nm)	(Nm)		Found	Foundation size(m)		para de la companya d	Base Weight	Endurance strength of ground	Lateral Pressure
Z	č	ò	×,×	, N	q	Р	h nd p	nd part lengtoor thicknes		W(N)	q'(kN/m2)	q'(kN/m2)   s(kN/m2)=0.5c
local local	00	00	612.5	0.0	09.0	0.45	0.55	0.35	0.10	3,341	20	25.0
	00	00	6737.2	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0
	135.7	00	612.5	305.4	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0
	000	135.7	9179	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	50.0
	637.4	00	4947.2	1434.2	09.0	0.45	0.55	0.35	0.10	3,341	100	50.0
Short period blow down + Holizontal 3749 2	00	0.086	7152.2	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	50.0
	637.4	0.0	-6612.0	1434.2	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0
	0.0	-980.0	-8817.0	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0

subsidence load		Endurance strength of ground	
(N) M+N	1	(N) bxpxq	
8413	/	27000 0	×

erm wind blow up)			262500 OK!
oncrete floor bearing capacity (short term wind blow up,	bearing capacity	$f_c \times b \times 0.875t/2(N)$	2625
o		1	/
Concrete flo	share force	(N) Ø	67108

			The second secon	1000000				
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		JUDG	JUDGMENT
	N+W(N)	$(N+W)/(b \times q')$	(d-t)/2		Mx(N·m)	Mx/MRx	MR	MR≧M
long period load	3888.5	0.130	0.160	2,142			0.071 <1.0	OK -
Short period load	8412.8		0.155	4,341	1684.3		<ul><li>1.0</li><li>1.0</li></ul>	송
Short term earthquake X	3888.5	0.065	0.193	3,786	153.1	0.040		ð
Short term earthquake Y	3888.5	0.065	0.193	3,786	232.9	0.061	V1.0	Š
Short period blow down + Holizontal X	7090.5	0.118	0.166	4,214	1236.8			ok
Short period blow down + Holizontal	7090.5	0.118	0.166	4,214			<1.0	ð
Short period blow up+Holizontal X	0.0	0000	0.225	3,038	-1653.0		<ul><li>1.0</li></ul>	ð
Short period blow up+Holizontal Y	0.0	0.000	0.225	3,038	-2228.8	0.734	<1.0	o K

Vertical load         t(m)         e(m)         Resistance MRx         Fall Mx         Action load         VMX/MRx           N+W(N)         (N+W)/(b x q²)         (d-t)/2         MRx/(N·m)         Mx/MRx         Mx/MRx           3888.5         0.086         0.257         3,277         79.7         0.024            17         7090.5         0.158         0.221         3,847         374.5         0.097            0.0         0.000         0.300         2,278         374.5         0.164          0.164					Y direction					٦
N+W(N)		Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		-	JUDGMENT	
10   10   10   10   10   10   10   10		(N)M+N	(N+W)/(P × d')	(d-t)/2	MRx(N·m)	-	Mx/MRx		MR≧M	
Holizontal 3 7090.5 0.158 0.221 3,847 374.5 contal x 0.0 0.000 0.300 2,278 374.5	Short term earthquake X	3888.5		0.257			0.024	<1.0	$\sim$	
0.0 0.000 0.300 2,278 374.5	Short period blow down + Holizontal X	7090.5		0.221	3,847		0.097	<1.0		
	Short period blow up+Holizontal X	0.0		0.300			0.164	<1.0	OK 	

# STATIC REPORT

PJR-series

5033-H23

#### 1. Material and Evaluation

#### 1)Post

Materi A6063S-T6(SS)

Material performance

١	Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
	DE8388	13.90	563.62	173.23	75.15	36.47	70000	3.53	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb + \sigma c/fc =$ 

0.61 < 1.0 OK!

Wind blow down

 $\sigma b/fb + \sigma c/fc =$ 

0.60 < 1.0 OK!

Wind blow up

 $\sigma b/fb + \sigma t/ft =$ 

0.68 < 1.0 OK!

2 · lk/i=

115.6 < 140 OK!

#### 2Beam

Materi A6063S-T6(SS)

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8393	9.06	231.70	60.75	37.37	18.13	70000	2.59	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb=$ 

0.72 < 1.0 OK!

Wind blow down

 $\sigma bx/fbx=$ 

0.53 < 1.0 OK!

Wind blow up

 $\sigma$ bx/fbx=

0.71 < 1.0 OK!

#### 3 Main frame

Materi A6063S-T6(SS)

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8578有	1.64	5.33	2.07	2.27	0.91	70000	1.13	180

Material evaluation

 $\sigma b/fb=$ 

0.29 < 1.0 OK!

#### 4 Front frame

Materi A6063S-T5

Material performance

Γ	Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
	DE8401	2.55	12.50	6.91	3.81	2.20	70000	1.65	132

Material evaluation

 $\sigma b/fb=$ 

0.14 < 1.0 OK!

#### **⑤**Rear frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8404有	2.55	7.70	5.90	2.34	1.82	70000	1.52	132

Material evaluation

 $\sigma b/fb=$ 

0.19 < 1.0 OK!

#### (6)Rafter

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8654+DE8666	1.88	0.36	3.75	0.53	1.48	70000	1.41	132

Material evaluation

 $\sigma b/fb=$ 

0.57 < 1.0 OK!

7 Side frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8683+DE8412	1.65	0.40	2.00	0.32	0.93	70000	1.10	132

Material evaluation

 $\sigma b/fb=$ 

0.40 < 1.0 OK!

®Corner bracket

Materi SPFH590

Material performance

	Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
L	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
L	GB8064	8.58	205.21	65.07	28.12	20.34	210000	2.75	420

Material evaluation (without support and side panel Vex=38m/s)

 $\sigma$  bx/fb=

0.52 < 1.0 OK!

 $\sigma$  by/fb=

0.10 < 1.0 OK!

9Main frame connecting parts

Materi A6063S-T5

Material performance

1	Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
-		(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
	GB8086	2.77	5.59	1.85	2.87	1.69	70000	0.82	132

Material evaluation

τ /fs=

0.01 < 1.0 OK!

**10** Front frame connecting parts

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8084	2.62	6.94	4.75	2.95	2.26	70000	1.35	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

①Rear frame connecting parts

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Waterial	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8085	1.92	2.92	1.83	1.78	1.40	70000	0.98	132

Material evaluation

τ /fs=

0.01 < 1.0 OK!

12Roof material

Materi

polycarbonate

Material performance

Material	Thickness	Length(short part)	Length(long part)	Inserting	Poisson ratio	Elasticity factor	F value	
Material	cm	cm	cm	cm	ν	kgf/cm2	kgf/cm2	
GB4107	0.18	70.3	326.4	1.89	0.3	21000	551	

Material evaluation

Bending volume : Wmax=

1.82 cm

44.50 kgf/cm<sup>2</sup>

 $551.0 \text{ kgf/cm}^2$ 

∴ok!

 $\max \sigma \, \mathbf{x} =$  Necessary depth of insert  $\Delta \, \mathbf{L}$ 

0.31 cm depth or more

1.89 cm

..ok!

13Roof retainer

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8411	0.79	0.03	1.84	0.08	0.72	70000	1.52	132

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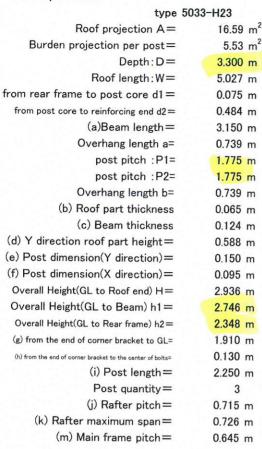
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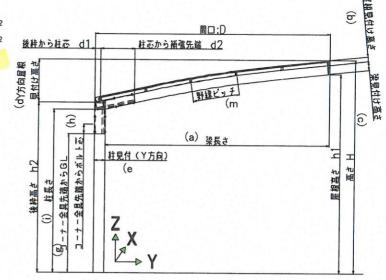
Material evaluation

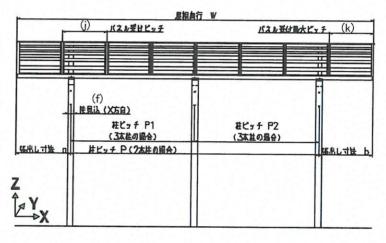
 $\sigma b/fb=$ 

0.18 < 1.0 OK!

#### 2. Carport detail







#### 3. Load design

①Vertical over load (G)

Part Weight

Roof	60.0 N/m <sup>2</sup>
Post	36.8 N/m

2 Snow over load

Post quantity	Snow area	Snow quantity	Unit weight	Short period snow period
2 posts type	General area	20 cm	30 N/m <sup>2</sup> /cm	600 N/m <sup>2</sup>

#### 3 Wind blowing load(Vex=38m/s)

·For design of structure frame

708 N/m<sup>2</sup> Speed pressureq=0. 6E(Vex•y)2= Standard wind speedVex= 38 m/s E=Er2Gf= 1.194  $Er = 1.7(Zb/Z_G)^{\alpha} =$ 0.691 Ground surface Div. Ш Gust influence factor Gf= 2.5 Zb= 5  $Z_G =$ 450  $\alpha =$ 0.2

·For roof material design

Installation period factor y=

Average speed pressure q' = 0.  $6Er2(Vex \cdot y)^2 = 283 \text{ N/m}^2$ 

0.827

4 Earthquake power

Earthquake power Qi=Z·Rt·Ai·Co·Wi

 $\begin{array}{ccc} \text{Area factorZ} = & 1.0 \\ \text{Vibration feature Rt} = & 1.0 \\ \text{Coat shear power distribution factorAi} = & 1.0 \\ \text{Standard shear power factorC}_{\circ} = & 0.3 \\ \end{array}$ 

#### 4. Preparing calculation

4-1 Carport load (For earthquake power calculation)

Roof	332	N	
Post	83	N	
Wi=	415	N	

Earthquake power Qi=Z·Rt·Ai·Co·Wi=

124.4 N

#### 4-2 Wind pressure power calculation (Maximum wind power pressure for 1 post)

·For design of structure frame

Wind factor

Independent shed

10°

C=

0.60 (+pressure)

-1.00 (-pressure)

1.2 (Post flat power, side panel)

Wind pressureW=q C=

425 N/m<sup>2</sup>

(Wind blow down)

 $-708 \text{ N/m}^2$ 

(Wind blow up)

849 N/m<sup>2</sup>

(Flat)

#### ·Roof material design

Peak with factor calculation process Gpe=

3.1 (+pressure)

3.0 (-pressure: panel center part)

4.0 (-pressure: panel surrounding part)

Peak wind factor Cf=

X

0.60

3.0

-1.00

1.86 -3.00

4.0

3.1

-1.00

-4.00

Wind pressure W=q' Cf=

527 N/m<sup>2</sup>  $-849 \text{ N/m}^2$ 

(Wind blow down)

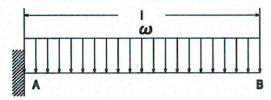
(Wind blow up)

 $-1132 \text{ N/m}^2$ 

(Wind blow up)

#### 5. Beam material examination

#### 5-1 Beam load(without support Vex=38m/s)

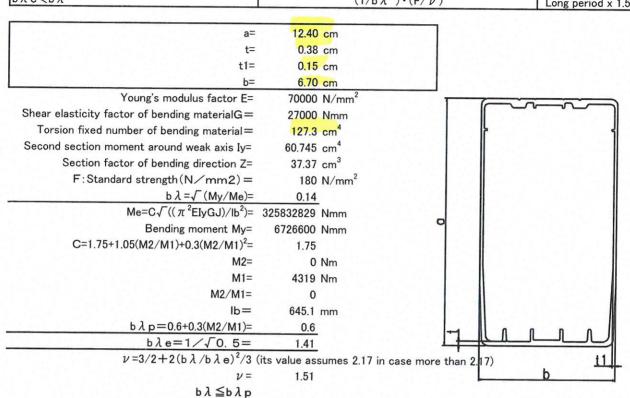


#### Load chart

Туре			
Vertical load width (m)			1.775
I (m)	D-d1-d	2.741	
Load	Long period	106.5	
ω(N/m)	Short period	load	1171.5
	Short period blowing	ng down(vertical)	860.2
	Short period blowi	ng up(vertical)	-1149.7
	Short period blowi	ng down(horizontal)	133.8
	Short period earth	quake(vertical)	106.5
	Short period earth	quake(horizontal)	32.0
	Long period	load	400.1
	Short period	load	4400.8
Bending moment	Short period blowi	ng down(vertical)	3231.5
M(N·m)	Short period blowi	-4319.0	
	Short period blowi	502.5	
	Short period earth	400.1	
	Short period earth	120.0	
Maximum bending mon	maxMx	(long period)	
(N·m)		(short period)	4400.8
	maxMy	(long period)	
		(short period)	502.5
Second section mome	Ix(cm <sup>4</sup> )		231.7
	Iy(cm <sup>4</sup> )		60.7
Section factor	Zx(cm <sup>3</sup> )	37.4	
	Zy(cm <sup>3</sup> )		18.1
Elasticity factor	E(N/cm <sup>2</sup> )		7000000
Maximum bending stre	m bending streimax σ x		
(N/mm2)	max σ y		27.7
Vertical maximum defo		(cm)	5.10
	max δ x/I	1/	99
Flat maximum deforma		(cm)	2.22
	max δ y∕l	1/	226

## 5-2 Beam permissible stress degree Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
bλ≦bλp	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5



Permissible stress degree fb:  $F/\nu =$ 

119.5 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts (strong axis)

#### 1) Frange plate of beam \(dop/bottom face\)

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Гb = 0.85

a) Гb ≦ 1.34

fb = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fb = F - 0.248F \Gamma b$ 

c)  $2.69 < \Gamma b$ 

 $fb = 2.41 F/(\Gamma b^2)$ 

fb= 120.0 N/mm<sup>2</sup>

#### 2) Web plate of beam <side face>

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 3.94$ 

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

 $fb = 14.4 F/(\Gamma d^2)$ 

Therefore, result data is...

fbx= 108.5 N/mm<sup>2</sup> fbx= 162.7 N/mm<sup>2</sup>

108.5 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts (weak axis)

#### 1) Frange plate of beam <top/bottom face>

$$\Gamma b := b/t \cdot \sqrt{(F/E)}$$

Гь = 3.94

a) Γb ≦ 1.34

fb = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fb = F - 0.248F \Gamma b$ 

c)  $2.69 < \Gamma b$ 

 $fb = 2.41 F/(\Gamma b^2)$ 

2) Web plate of beam <side face>

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

Γd= 0.85

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

 $fb = 14.4 \, F/(\Gamma d^2)$ 

fb=

Therefore, result data is...

28.0 N/mm<sup>2</sup> fby= fby= 42.0 N/mm<sup>2</sup>

120.0 N/mm<sup>2</sup>

28.0 N/mm<sup>2</sup>

#### Section of the Beam examination

Snow for short period

4400.8 N·m M=

 $\sigma b =$ 117.8 N/mm<sup>2</sup>

0.72 < 1.0 OK!  $\sigma b/fb=$ 

Wind blow down

M= 3231.5 N·m

86.5 N/mm<sup>2</sup>  $\sigma bx =$ 

OK! 0.53 < 1.0  $\sigma bx/fbx=$ 

Wind blow up

-4319.0 N·m M=

115.6 N/mm<sup>2</sup>  $\sigma bx =$ OK!

 $\sigma$  bx/fbx= Wind blow horizontal 0.71 < 1.0

M= 502.5

27.7  $\sigma$  by=

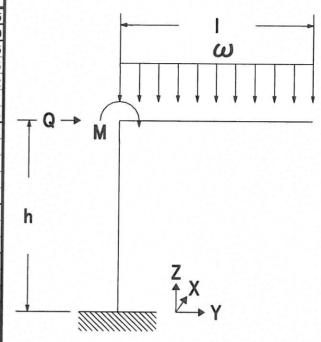
0.66 < 1.0 OK!  $\sigma$  by/fby=

#### 6. Post material examination

#### 6-1 Post load

#### Load chart

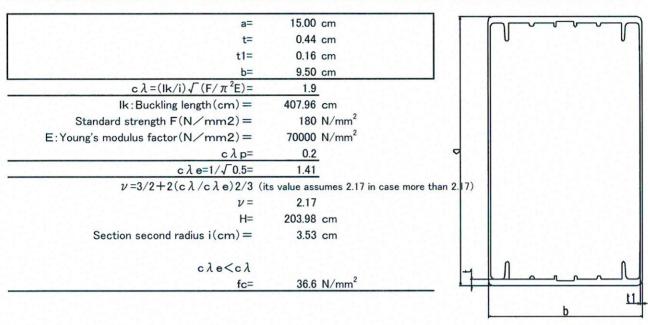
Load chart		
Type		
Vertical load width (m.		1.775
1 (m)	D-d1	3.150
	Long period load	106.5
Load	Short period snow load	1171.5
ω(N/m)	Short period blowing down(vertical	
	Short period blowing up(vertical)	-1149.7
	Short period earthquake(vertical)	106.5
	Long period load	434.2
Axial force	Short period snow load	3948.7
by vertical load	Short period blowing down(vertica	
N(N)	Short period blowing up(vertical)	-3711.4
	Short period earthquake(vertical)	434.2
Flat load	Short period wind X	
Q(N)	Short period wind Y	677.5
G(11)		738.0
	Short period earthquakeX、Y	99.5
Danding mamant	Long period load	528.4
Bending moment	Short period snow load	5812.1
M(N·m)	Short period blowing down(vertical	
	Short period blowing up(vertical)	-5704.1
n "	Short period earthquake(vertical)	528.4
Bending moment	Short period blowing down(vertical)+WindY	5928.4
by vertical and flat load	Short period blowing up(vertical)+WindY	-7364.7
Mx (N·m)	Short period earthquake(vertical) + Earthquak	752.3
Bending moment	Short period windX	1524.5
by flat load	Short period earthquakeX	224.0
My(N·m)		
Maximum bending	maxMx (long period)	
moment(N·m)	(short period)	7364.7
	maxMy (short period wind)	1524.5
	(short period earthqua	224.0
Second section moment	Ix(cm <sup>4</sup> )	563.623
	Iy(cm⁴)	173.23
Section factor	Zx(cm³)	75.15
	Zy(cm³)	36.47
Max. bending stress deg.	Long period load	7.03
$\sigma x(N/mm2)$	Short period snow load	77.34
	Short period blowing down(vertical	56.79
	Short period blowing up(vertical)	-75.90
	Short period earthquake(vertical)	7.03
	Short period blowing up(vertical)+WindY	78.89
	Short period blowing down(vertical)+WindY	-98.00
	Short period earthquake(vertical) + Earthquak	10.01
max σx(N/mm2)	Long period	7.03
(uniaxial bending)	Short period (Y direction Vertical load)	98.00
Bending stress degree	Short period windX	41.80
$\sigma_y(N/mm2)$	Short period earthquakeX	6.14



#### 6-2 Post permissible stress degree

Permissible pressure stress degree

	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
cλ≦cλp	F/ <i>v</i>	Long period x 1.5
cλp <cλ≦cλe< td=""><td><math>(1.0-0.5((c\lambda-c\lambda p)/(c\lambda e-c\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></cλ≦cλe<>	$(1.0-0.5((c\lambda-c\lambda p)/(c\lambda e-c\lambda p)))F/\nu$	Long period x 1.5
cλe <cλ< td=""><td><math>(1/c \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></cλ<>	$(1/c \lambda^2) \cdot (F/\nu)$	Long period x 1.5



#### Permissible stress degree at bend parts

#### 1) Frange plate of beam <top/bottom face>

$$\Gamma b := b/t \cdot \sqrt{(F/E)}$$

fc=

fc=

- a) Γb ≦ 1.34
- fb = F/1.5
- a)  $1 b \ge 1.34$ b)  $1.34 < \Gamma b \le 2.69$
- $fb = F 0.248F \Gamma b$
- c)  $2.69 < \Gamma b$
- $fb = 2.41 F/(\Gamma b^2)$

#### 2) Web plate of beam <side face>

 $\Gamma d := d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 4.48$ 

- a) Γd ≦ 1.34
- fb = F/1.5
- b)  $1.34 < \Gamma d \le 2.69$
- $fb = F 0.248F\Gamma d$
- c) 2.69 <  $\Gamma$  d
- fb = 2.41 F/( $\Gamma d^2$ )

Therefore, result date is •••

fc=	21.7 N/mm <sup>2</sup>
fc=	32.5 N/mm <sup>2</sup>

21.7 N/mm<sup>2</sup>

120.0 N/mm<sup>2</sup>

Permissible bending stress degree

	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
bλ≦bλp	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	15.00	cm		
t=	0.44	cm		
t1=	0.16	cm		
b=	9.50	cm		
Young's modulus factor E=	70000	N/mm <sup>2</sup>		6
Shear elasticity factor of bending material G=	27000	Nmm		l A
Torsion fixed number of bending material=	329.6	cm <sup>4</sup>		
Second section moment around weak axis ly=	173.233	cm <sup>4</sup>		
Section factor of bending direction Z=	75.15	cm <sup>3</sup>		
F: Standard strength (N/mm2) =	180	N/mm <sup>2</sup>		
b $\lambda = \sqrt{(My/Me)}$	0.28			
$Me=C\sqrt{((\pi^2EIyGJ)/lb^2)}=$	170876462	Nmm	9	
Bending moment My=	13527000			
$C=1.75+1.05(M2/M1)+0.3(M2/M1)^2=$	1			
M2=	-5704.1	Nm		
M1=	5704.1	Nm		
M2/M1=	-1			

 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

1.53

1909.8 mm

0.3

1.41

ьλ≦ьλр

lb=

Permissble stress degree fb:  $F/\nu =$ 117.9 N/mm<sup>2</sup>

b  $\lambda$  e=1/ $\sqrt{0.5}$ =

 $b \lambda p=0.6+0.3(M2/M1)=$ 

Permissible bending stress degree (strong axis)

1) Frange plate \top/bottom face>

 $\Gamma$ b :The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

Гь = 1.06

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma b$ 

c) 2.69 <  $\Gamma$ b

 $fc = 2.41 F/(\Gamma b2)$ 

120.0 N/mm<sup>2</sup>

2) Web plate (side face)

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d =$ 4.48

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F \Gamma d$ 

c)  $6.57 < \Gamma d$ 

fb = 14.4 F/( $\Gamma d^2$ )

Therefore, result date is \*\*\* fbx= 98.6 N/mm<sup>2</sup> fbx= 148.0 N/mm<sup>2</sup>

98.6 N/mm<sup>2</sup>

#### Permissible bending stress degree (weak axis)

#### 1) Frange plate <top/bottom face>

 $\Gamma$  b :The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

Γb= 4.48

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c)  $2.69 < \Gamma b$ 

 $fc = 2.41 F/(\Gamma d2)$ 

fb= 21.7 N/mm<sup>2</sup>

#### 2) Web plate <side face>

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

fb=

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma d$ 

c)  $6.57 < \Gamma d$ 

fb =  $14.4 \text{ F/}(\Gamma d^2)$ 

Therefore, result date is ...

fby=	21.7 N/mm <sup>2</sup>	
fby=	32.5 N/mm <sup>2</sup>	

1.06

120.0 N/mm<sup>2</sup>

#### Examination of the section of the post

Short period snow load

 $\sigma$  b= 77.3 N/mm<sup>2</sup>  $\sigma$  c=N/A= 2.8 N/mm<sup>2</sup>

 $\sigma b/fb + \sigma c/fc = 0.61 < 1.0 OK!$ 

Wind blow down

 $\sigma$  b= 78.9 N/mm<sup>2</sup>  $\sigma$  c=N/A= 2.1 N/mm<sup>2</sup>

 $\sigma$ b/fb+ $\sigma$ c/fc= 0.60 <1.0 OK!

Wind blow up

 $\sigma$  b= 98.0 N/mm<sup>2</sup>  $\sigma$  t=N/A= 2.7 N/mm<sup>2</sup>

 $\sigma b/fb + \sigma t/ft = 0.68 < 1.0$  OK!

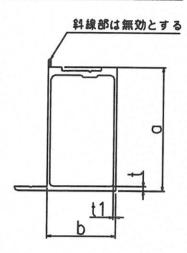
2·lk/i= 115.6 <140 OK!

#### 7. Main Frame Bending permissible stress degree

7-1 Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
ьλ≦ьλр	$F/\nu$	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	4.60	cm
t=	0.10	cm
t1=	0.09	cm
b=	2.50	cm
Young's modulus factor E=	70000	N/mm <sup>2</sup>
Shear elasticity factor of bending materialG=	27000	Nmm
Torsion fixed number of bending material =	3.2	cm <sup>4</sup>
Second section moment around weak axis Iy=	2.072	cm <sup>4</sup>
Section factor of bending direction Z=	2.274	cm <sup>3</sup>
F: Standard strength(N/mm2) =	180	N/mm <sup>2</sup>
b $\lambda = \sqrt{\text{(My/Me)}}$	0.27	
Me=C $\sqrt{((\pi 2EIyGJ)/lb2)}$ =	5535840	Nmm
Bending moment My=	409320	Nmm
C=	1.13	
lb=	715	mm
$b \lambda p=0.6+0.3(M2/M1)=$	0.3	
b λ e=1/√0.5=	1.41	



 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

bλ≦bλp

118.1 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

#### 1) Frange plate of beam (top/bottom face)

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

0.41

a) Γb ≤ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c)  $0.876 < \Gamma b$ 

fb =  $0.256 \text{ F/}(\Gamma \text{ b}^2)$ 

fb= 120.0 N/mm<sup>2</sup>

 $\Gamma$ b : The conversion ratio = b/t ·  $\sqrt{(F/E)}$ 

1.18

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c)  $2.69 < \Gamma b$ 

 $fc = 2.41 F/(\Gamma d2)$ 

120.0 N/mm<sup>2</sup> fb=

#### 2) Wave plate of beam (side face)

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Γd= 2.48

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

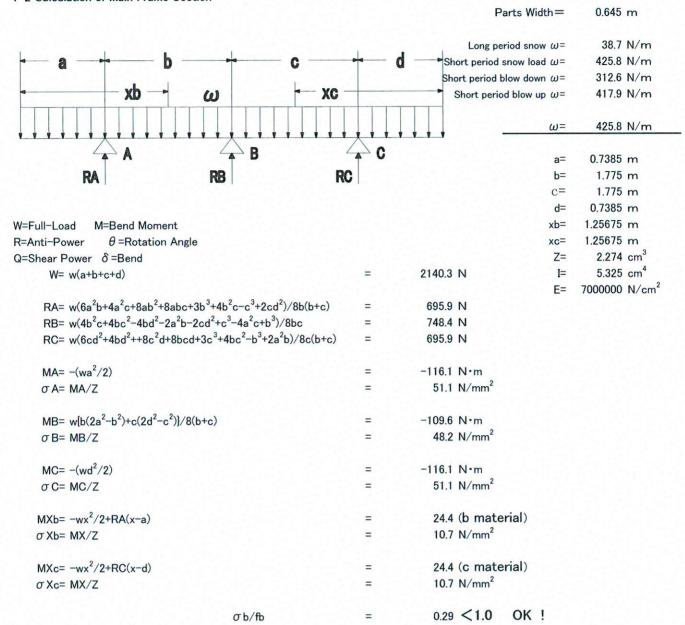
 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

fb = 14.4 F/( $\Gamma d^2$ )

120.0 N/mm<sup>2</sup> fb= Therefore, result data is... 118.1 N/mm<sup>2</sup> fb= 177.1 N/mm<sup>2</sup> fb=

#### 7-2 Calculation of Main Frame Section



#### 8. Front frame bending permissible stress degree

8-1 Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)	
Ьλ≦Ьλр	F/ν	Long period x 1.5	
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5	
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5	

a=	4.77	cm			
t=	0.10	cm			
t1=	0.10	cm			
b=	4.20	cm			
Young's modulus factor E=	70000	N/mm <sup>2</sup>		_	
Shear elasticity factor of bending materialG=	27000	Nmm			
Torsion fixed number of bending material=	8.4	cm <sup>4</sup>			
Second section moment around weak axis ly=	6.911	cm <sup>4</sup>			
Section factor of bending direction Z=	3.805	cm <sup>3</sup>	- 2654 6		- //
F: Standard strength(N/mm2) =	132	N/mm <sup>2</sup>			//
b $\lambda = \sqrt{\text{(My/Me)}}$	0.17		9		
$Me=C\sqrt{((\pi 2EiyGJ)/lb2)}=$	16407392	Nmm			
Bending moment My=	502260	Nmm			
C=	1.13		1	t1	
lb=	715	mm			b

1.41  $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

0.3

$$\nu$$
 = 1.51  $b \lambda \leq b \lambda p$ 

fb=	07 4 NI /2	
ID-	87.4 N/mm <sup>2</sup>	

#### Permissible stress degree at bend parts

#### 1) Frange plate of beam <top/bottom face>

 $\Gamma \, b \,$  : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

a) Γb ≦ 1.34

$$fc = F/1.5$$

 $b \lambda p = 0.6 + 0.3 (M2/M1) =$ 

bλ e=1/√0.5=

b)  $1.34 < \Gamma b \le 2.69$ 

$$fc = F - 0.248F \Gamma d$$

c) 2.69 < Гb

$$fc = 2.41 F/(\Gamma d2)$$

75.1 N/mm<sup>2</sup> fb=

#### 2) Web plate of beam <side face>

$$\Gamma d = d/t \cdot \sqrt{(F/E)}$$

$$\Gamma d = 1.98$$

a) Γd ≦ 3.29

$$fb = F/1.5$$

b)  $3.29 < \Gamma d \leq 6.57$ 

$$fb = F - 0.101F\Gamma$$

c)  $6.57 < \Gamma d$ 

fb = 14.4 F/(
$$\Gamma d^2$$
)

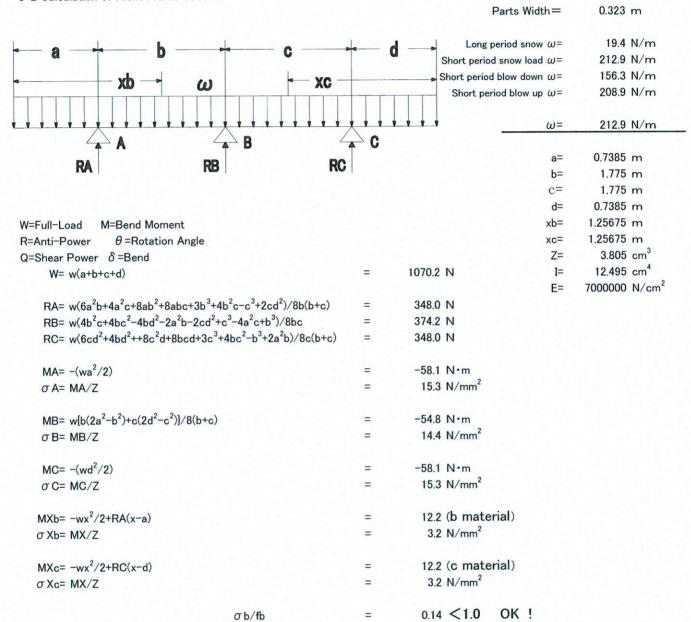
fb=

Therefore result data is...

	fb=	112.7 N/mm <sup>2</sup>	
	fb=	75.1 N/mm <sup>2</sup>	
Therefore, result data is			

88.0 N/mm<sup>2</sup>

#### 8-2 Calculation of Front Frame Section



#### 9. Bending permissible stress degree at rear frame

#### 9-1 Calculation method of effective section

 $\Gamma b = b/t \cdot \sqrt{(F/E)} = 0.438$  $b/t = 0.438/\sqrt{(F/E)} = 10.09$ 

Therefore...

Effective Depth

t2=

1.70 mm 17.15 mm

b1=

9-2. Bending permissible stress degree at rear frame

Bending permissible stress degree

Dending permissible stress degree		
	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
ьλ≦ьλр	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td>(1/b λ<sup>2</sup>)·(F/ν)</td><td>Long period x 1.5</td></bλ<>	(1/b λ <sup>2</sup> )·(F/ν)	Long period x 1.5

料線部は無効とする

a= 3.82 cm t= 0.12 cm t1= 0.12 cm b= 2.95 cm

Young's modulus factor E= 70000 N/mm<sup>2</sup> Shear elasticity factor of bending materialG= 27000 Nmm Torsion fixed number of bending material= 4.0 cm4 Second section moment around weak axis Iy= 7.702 cm<sup>4</sup> Section factor of bending direction Z= 2.344 cm<sup>3</sup> F: Standard strength(N/mm2) =132 N/mm<sup>2</sup>  $b \lambda = \sqrt{(My/Me)}$ 0.16  $Me=C\sqrt{((\pi^2EIvGJ)/lb^2)}=$ 12025195 Nmm 309408 Nmm Bending moment My=



b  $\lambda$  p=0.6+0.3(M2/M1)= 0.3 b  $\lambda$  e=1/ $\sqrt{0.5}$ = 1.41

 $\nu$  =3/2+2(b  $\lambda$  /b  $\lambda$  e)<sup>2</sup>/3 (its value assumes 2.17 in case more than 2.17)  $\nu$  = 1.51

Ьλ≦Ьλр

fb= 87.5 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

#### 1) Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

Γb = 0.98

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c) 2.69 < Гb

 $fc = 2.41 \, F/(\Gamma d2)$ 

fb= 88.0 N/mm<sup>2</sup>

#### 2) Web plate of beam (side face)

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 1.30$ 

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

fb =  $14.4 \, \text{F/}(\, \Gamma \, \text{d}^2)$ 

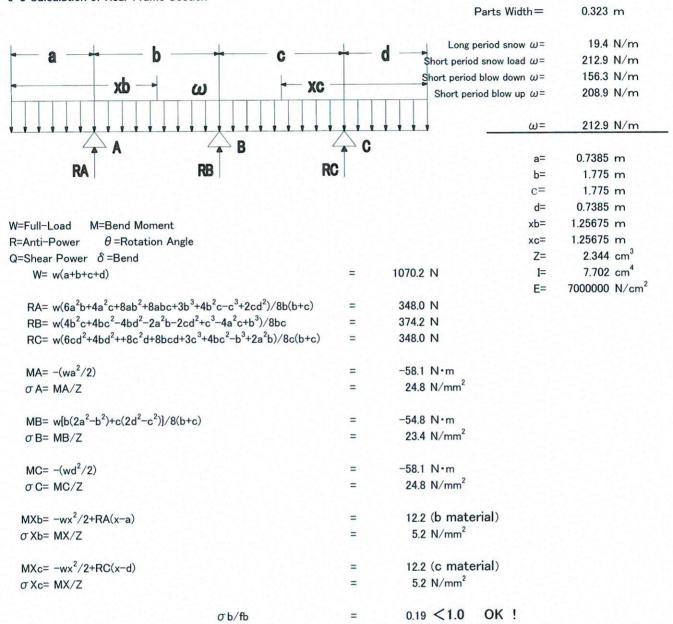
Therefore, result data is···

fb= 87.5 N/mm<sup>2</sup>

fb= 131.2 N/mm<sup>2</sup>

88.0 N/mm<sup>2</sup>

#### 9-3 Calculation of Rear Frame Section

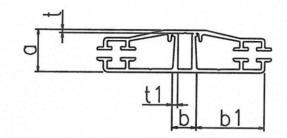


#### 10. Rafter / Roof retainer bending permissible stress degree

10-1 Bending permissible stress degree

a=	1.30 cm
t=	0.10 cm
t1=	0.17 cm
b=	0.72 cm
b1=	1.99 cm

Young's modulus factor E=  $70000 \text{ N/mm}^2$ Shear elasticity factor of bending materialG= 27000 NmmSecond section moment around weak axis Iy=  $0.364 \text{ cm}^4$ Section factor of bending direction Z=  $0.529 \text{ cm}^3$ F: Standard strength (N/mm2) =  $132 \text{ N/mm}^2$ 



Therefore...

 $fb = 88.0 \text{ N/mm}^2$ 

#### Permissible stress degree at bend parts

#### Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

Гь = 0.86

a) Гb ≦ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c) 0.876 <  $\Gamma$ b

fb =  $0.256 \, F/(\Gamma \, b2)$ 

fb=  $45.3 \text{ N/mm}^2$ 

Therefore...

fb=	45.3 N/mm <sup>2</sup>	
fb=	68.0 N/mm <sup>2</sup>	

10-2 Calculation of Rafter / Roof retainer section

				Parts Width=	0.715 m
-		- 1 -	<del>-+</del> 1 <del>+</del> 1 <del></del>	E	0.645 m
				Long period $\omega$ =	42.9 N/m
				Short period snow load $\omega$ =	471.9 N/m
****	*******	* * *	· · · · · · · · · · · · · · · · · · ·	Short period blow down $\omega$ =	346.5 N/m
A 1	B 2 C	3	D 2 E 1 F	Short period blow up $\omega$ =	-463.1 N/m
				ω=	471.9 N/m
				Z=	0.529 cm <sup>3</sup>
W=Full-Loa				I=	0.364 cm <sup>4</sup>
R=Anti-Pov		gle		E=	7000000 N/cm <sup>2</sup>
Q=Shear Po	ower δ=Bend			<b>C</b> -	7000000 N/ CM
	ωι	=	304.4 N		
RA=	0.395 * ωΙ	=	120.2 N		
RB=	$1.131 * \omega 1$	=	344.3 N		
RC=	$0.974 * \omega 1$	=	296.5 N		
RD=	$0.974 * \omega 1$	=	296.5 N		
RE=	$1.131 * \omega I$	=	344.3 N		
RF=	0.395 * ωI	=	120.2 N		
Rmax=			344.3 N		
MB=	$-0.105+*\omega1^{2}$	=	-20.6 N•m		
MC=	$-0.079 * \omega 1^{2}$	=	-15.5 N•m		
MD=	$-0.079 * \omega 1^{2}$	=	−15.5 N·m		
ME=	$-0.105 + * \omega  ^{2}$	=	-20.6 N•m		
M1=	$0.078 * \omega 1^{2}$	=	15.3 N⋅m		
M2=	$0.033 * \omega 1^{2}$	=	6.5 N•m		
M3=	0.046 * ωl <sup>2</sup>	=	9.0 N·m		
σ X=	MX/Z	=	39.0 N/mm²		

0.57 < 1.0 OK!

 $\sigma$ b/fb =

#### 11. Side frame bending permissible stress degree

#### 11-1 Calculation method of effective section

 $\Gamma b = b/t \cdot \sqrt{(F/E)} = 0.438$ 

Therefore···

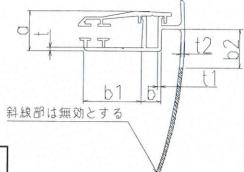
 $b/t = 0.438/\sqrt{(F/E)} = 10.09$ 

Effective Depth

t2= 1.20 mm

b2= 12.10 mm

11-2 Bending permissible stress degree



a=	1.30 cm	
t=	0.11 cm	
t1=	0.17 cm	
b=	0.72 cm	
b1=	1.99 cm	
	2	

Young's modulus factor E=

70000 N/mm<sup>2</sup>

Shear elasticity factor of bending materialG=

27000 Nmm

Second section moment around weak axis Iy=

2 cm<sup>4</sup>

Section factor of bending direction Z=

0.324 cm<sup>3</sup>

F: Standard strength (N/mm2) =

132 N/mm<sup>2</sup>

Therefore···

 $fb = 88.0 \text{ N/mm}^2$ 

# Permissible stress degree at bend parts Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

Гь=

0.79

a) Γb ≤ 0.438

fb = F/1.5

b) 0.438 < Γb ≤ 0.876

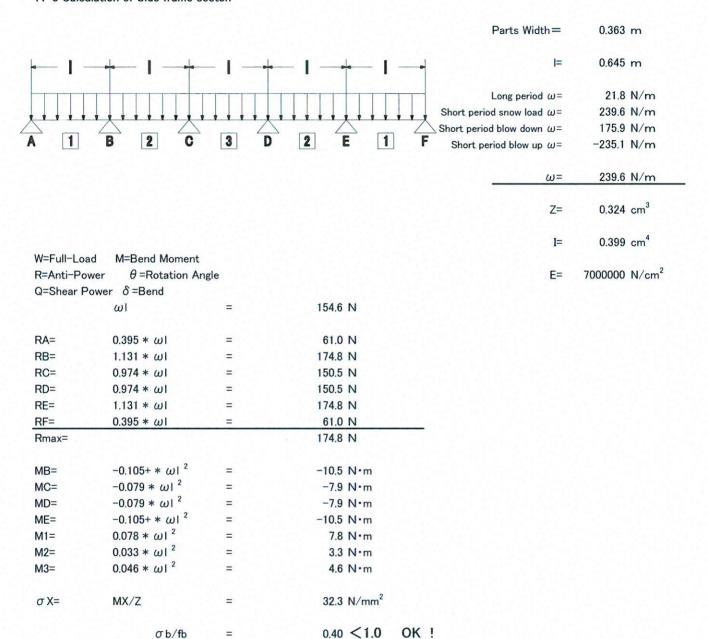
 $fb = F - 0.760F \Gamma b$ 

c) 0.876 < Гь

 $fb = 0.256 F/(\Gamma b2)$ 

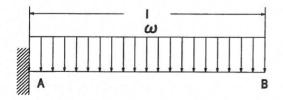
	TD-	33.2 N/mm	
Therefore···			
	fb=	53.2 N/mm <sup>2</sup>	
	fb=	79.8 N/mm <sup>2</sup>	

11-3 Calculation of Side frame secton



#### 12. Corner bracket examination

#### 12-1 Beam load



#### Load chart

Туре					
Vertical load width (m)			1.775		
I (m)	D-	D-d1			
Load	Long period	d load	106.5		
ω(N/m)	Short perio	Short period snow load			
	Short period blov	wing up(vertical)	860.2		
	Short period blov	wing up(vertical)	-1043.2		
	Short period blov	wing down(horizontal)	160.5		
	Short period ear	thquake(vertical)	106.5		
	Short period ear	thquake(horizontal)	32.0		
	Long period	load	553.8		
	Short perio	d snow load	6092.2		
Bending moment	Short period blov	ving up(vertical)	4473.5		
M(N·m)	Short period blov	ving up(vertical)	-5425.1		
	Short period blov	834.7			
	Short period eart	553.8			
	Short period eart	hquake(horizontal)	166.1		
Maximum bending momen	maxMx	(long period)			
(N·m)		(short period)	6092.2		
	maxMy	(long period)			
		(short period)	834.7		
Second section moment	Ix(cm <sup>4</sup> )		231.7		
	Iy(cm⁴)		60.7		
Section factor	Zx(cm <sup>3</sup> )	37.4			
	Zy(cm <sup>3</sup> )		18.1		
Elasticity factor	E(N/cm <sup>2</sup> )		21000000		
Maximum bending stress degree	max σ x		163.0		
(N/mm2)	maxσy		46.0		
	max δ x	(cm)	3.26		
	max δ x / I	1/			
	maxδy	(cm)	1.70		
	$\max \delta y/I$	1/	295		

#### 12-2 Calculation of Corner bracket Section

Material	Second sec	tion moment	Section factor		
Material	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	
GB8064	205.211	65.073	28.119	20.335	

fb= 420 N/mm<sup>2</sup> 6092.2 N·m Mx= My= 834.7 N·m 216.7 N/mm<sup>2</sup>  $\sigma$ bx= 41.0 N/mm<sup>2</sup>  $\sigma$ by= 0.52 < 1.0 OK!  $\sigma$  bx/fb= 0.10 < 1.0 OK!  $\sigma$  by/fb=

#### 13. Examination of main frame connecting part

#### 13-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

344.3 N

←from "Calculation of rafter"

·Anti-Power of connecting rafter

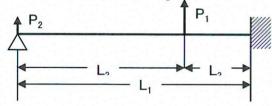
Po=

P2=

172.2 N

←(Anti-Power of rafter)/2

#### 13-2 Examination of shearing force



0.74
0.715
0.02
276.8
76.2

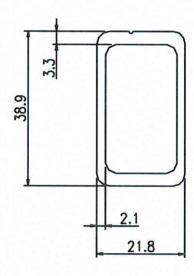
$$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_3$$

172.7 N

 $\tau = Q/A =$ 

0.62 N/mm<sup>2</sup>

0.01 < 1.0 OK!



#### 14. Examination of front frame connecting part

#### 14-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

120.2 N

←from "Calculation of rafter"

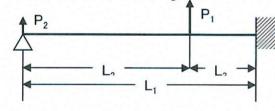
· Anti-Power of connecting rafter

P2=

60.1 N

←(Anti-Power of rafter)/2

#### 14-2 Examination of shearing force



L <sub>1</sub> (m)	0.74
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.02
A(mm <sup>2</sup> )	261.6
fs(N/mm²)	76.2

$$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + U_3$$

Q=

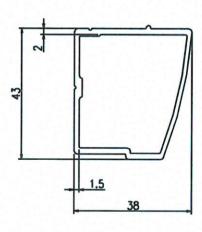
60.3 N

0.23 N/mm<sup>2</sup>  $\tau = Q/A =$ 

 $\tau$  /fs=

0.01 < 1.0

OK!



#### 15. Examination of gutter connecting part

#### 15-1 Calculation of Load

·Anti-Power of rafter

120.2 N

←from "Calculation of rafter"

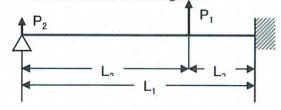
· Anti-Power of connecting rafter

P2=

60.1 N

 $\leftarrow$ (Anti-Power of rafter)/2

#### 15-2 Examination of shearing force



L <sub>1</sub> (m)	0.74
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.02
A(mm <sup>2</sup> )	192.1
fs(N/mm <sup>2</sup> )	76.2

 $Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_3$ 

Q=

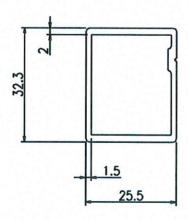
60.3 N

 $\tau = Q/A =$ 

0.31 N/mm<sup>2</sup>

T /fs=

0.01 < 1.0 OK!



#### 16. Examination of main frame and beam connection

#### 16-1 Examination of screw pull-out force

·Pull-out force/screw

374.2 N

·Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
= 172.7 N/mm<sup>2</sup>

•Effective section

A= 
$$11.2 \text{ mm}^2$$
  
 $\sigma t= 33.3 \text{ N/mm}^2$ 

$$\sigma t/ft=$$
 0.19 < 1.0 OK!

# β 0.6 Screw diameter 5 Core diameter 3.78 Pitch 0.8 t(Thickness) 4.6 Ft(Standard strength) 100

#### b (Beam depth dimension) 61 t (Thickness) 2.4 a (load point) 18.5

#### 16-2 Examination of Beam bending stress

\*Beam top face bending moment

M=	2099.6	N·mm	
Z=	58.6	mm <sup>3</sup>	
$\sigma$ b=	35.9	$N/mm^2$	
b/fb=	0.17	<1.0	C

 $\sigma \, b/fb = 0.17 \, < 1.0 \, OK \, !$ 

#### 17. Examination of rafter and main frame connection

#### 17-1 Examination of screw pull-out force

·Pull-out force/screw

\*Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $104.5 \text{ N/mm}^2$ 

Effective section

A=	6.7	mm <sup>2</sup>		
σt=	51.1	$N/mm^2$		
Tt/ft=	0.49	<1.0	OK	!

#### 17-2 Examination of Main frame bending stress

· Main frame top face bending moment

M=	991.6	$N \cdot mm$			
Z=	22.0	mm <sup>3</sup>			
$\sigma$ b=	45.0	$N/mm^2$			
$\sigma$ b/fb=	0.22	<1.0	OK	Ī	

β	0.6
Screw diameter	4
Core diameter	2.93
Pitch	0.7
t(Thickness)	2.3
Ft (Standard strength)	100

b(Beam depth dimension)	25
t(Thickness) center	2.3
a(load point)	10

#### 18. Examination of Roof material

#### 18-1 Examination of Bending volume

Poisson ratio :  $\nu =$ 0.3 Bending volume: Wmax 0.0116 kgf/cm<sup>2</sup> A · Wmax<sup>3</sup>+B · Wmax+C=0 Distribution Load :P= 21000 kgf/cm<sup>2</sup> E: Young's modulus factor =  $A = (4 \nu /a^2b^2 + (3 - \nu^2) \cdot (1/a^4 + 1/b^4))/h^3$ Thickness:h= 0.18 cm Short edge a= 70.3 cm 2086.4 Long edge b= 326.4 cm

 $B = (4/3) \cdot (1/a^2 + 1/b^2)^2/h$ 33.2

 $C = -256(1 - \nu^2)P/(\pi^6Eh^4)$ -12701.0

Bending volume : Wmax=

1.82 cm

#### 18-2 Bending stress degree

$$\max \sigma x = ((\pi^2 \cdot E \cdot Wmax)/(8 \cdot (1 - \nu^2))) \cdot ((2 - \nu^2) Wmax + 4h)/a^{2+} (\nu (Wmax + 4h))/b2)$$

$$= 44.5 \text{ kgf/cm}^2 < 551 \text{ kgf/cm}^2 \cdot \cdot \cdot \text{OK}!$$

#### 18-3 Necessary depth of insert

Necessary depth of insert AL

 $\Delta L = \Delta X \times SF + \Delta I$ 

However,  $\Delta X$ : The gap volume by a bend

= (lx - b)/2

Ix: Arc length while bending

 $= 2 \times \sin(1(b/2)/r) \times r$ 

r: Radius rate while bending

 $= (b2+4\delta2)/8\delta$ 

 $\delta$ : Bending rate of Polycarbonate = Wmax (cm)

b: Length of short (cm)

ΔI: The volume of expansion and contraction at temperature

 $= K \cdot \Delta t \cdot b/2$ 

 $\mathsf{K}\;$  : Line coefficient of expansion (cm/cm/°C)

∆t : Temperature differency at 50°C

SF: Safety ratio SF=3. 0

339.8 r= Ix= 70.43 cm  $\Delta X =$ 0.06 cm K= 0.00007 cm/cm/°C  $\Delta t =$ 50 °C SF= 3.0  $\Delta I =$ 0.12 cm

Therefore...

<  $\Delta L=$ 0.31 cm depth or more 1.89 cm ∴ok !

#### 19. Examination of Roof retainer

Rafter pitch=	715 mm		
Supporting length I=	15 mm		
Material thickness t=	1.2 mm		
F: Standard strength=	132 N/mm <sup>2</sup>		
Blow up load $\omega =$	383.4 N/m	25 25	کے کے
Load $P = \omega b =$	3.834 N		
$M=P\cdot I=$	5.8 Ncm		
Section factor Z=bt <sup>2</sup> /6=	0.002 cm <sup>3</sup>		-
$\sigma$ b=M/Z=	24.0 N/mm <sup>2</sup>		
σ b/fb=	0.18 < 1.0	OK !	

# 20. Ground Foundation

20-1 Without concrete floor Resistance moment

Σœ

 $M_R=(N+W)\times e+q$ 's  $\times b\times h_1\times (h_1+h_0)$ 

Resistance moment  $M=M'+Q*(h/2)-N \times (d/2-a)$ 

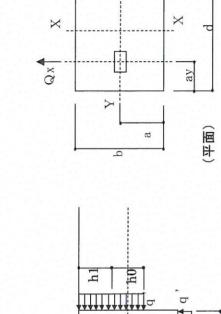
Base Foundation Lateral Pressure 발바

ay= ax= Endurance strength of ground Fe= Short Term Permissible Endurance strength of ground q= No line concrete Volume weight

h/2	- h		lu h			出場	(国国)		
	0.5	0.90 m	1.10 m	0.55 m	0.30 m	0.45 m	100 KN/m <sup>2</sup>	200 KN/m <sup>2</sup>	22.5 KN/m <sup>3</sup>

4444

M



Qy

	Spindle Force(N)	Shear power(N)	ver(N)	Moment(Nm)	(Nm)		Foundation size(m)	ze(m)		Base Weight	Endurance strength of ground	Lateral Pressure
	z	ŏ	Q	M,×	M'y	q	ф	ч	a	(N)M	q'(kN/m2)	s(kN/m2)=0.5c
Long period load	434.2	0.0	0.0	528.4	0.0	06.0	1.10	0.55	0.30	12,251	100	20.0
Short period load	3948.7	0.0	0.0	5812.1	0.0	06.0	1.10	0.55	0.30	12,251	200	
Short term earthquake X	434.2	99.5	0.0	528.4	224.0	06.0	1.10	0.55	0.30	12,251	200	100.0
Short term earthquake Y	434.2	0.0	99.5	752.3	0.0	06.0	1.10	0.55	0.30	12,251	200	
Short period blow down + Holizontal	2921.5	677.5	0.0	4267.9	1524.5	06.0	1.10	0.55	0.30	12,251	200	
Short period blow down + Holizontal	2921.5	0.0	738.0	5928.4	0.0	06.0	1.10	0.55	0.30	12,251	200	
Short period blow up+Holizontal X	-3711.4	677.5	0.0	-5704.1	1524.5	06.0	1.10	0.55	0.30	12,251	200	
Short period blow up+Holizontal Y	-3711.4	0.0	-738.0	-7364.7	0.0	06'0	1.10	0.55	0:30	12,251	200	

subsidence load Endurance strength of ground	5	Endurance strength of ground	
(N) M+N	1	$p \times d \times q$ (N)	
16200	/	198000	OK!

Examination of uplift (short period blow up) X .  $<\frac{b \times d \times h \times \gamma(N)}{12251}$  OK! Base weight 3711 uplift load z z

t(m) (N+W)/(b	e(m) (d-t)/2	(50)	14()				
q)/(N+N)	(d-t)/2	(11)(11)	m (m)	Resistance MRx	Fall Mx	,	JUDGMENT
		Qy/(b × q's)	(h-h0)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MR≧M
	1 0.480	0000	0.275	9,486	419.8		<1.0 OK
	0 0.505	0000	0.275	14,987	4824.9		<1.0 OK
Short term earthquake X	0 0.515	0000	0.275	13,336	419.8		<1.0 OK
Short term earthquake Y 0.070	0 0.515	0.001	0.274		671.1		
Short period blow down + Holizontal X 0.084	4 0.508	0000	0.275	14,512	3537.5		<1.0 OK
Short period blow down + Holizontal Y 0.084	4 0.508	800.0	0.271	14,510	5401.0	0.372 <	
Short period blow up+Holizontal X 0.047	7 0.526	0000	0.275	11,301	-4776.3	V	<1.0 OK
Short period blow up+Holizontal Y 0.047	7 0.526	0.008	0.271	11,299	-6639.8		<1.0 OK
			Y direction	on			
(**)+	(m)	(50) (10)	h1()	Designation of Alb.	F-11 h A.:		FIATAGO

				Y direction	on				
	t(m)	e(m)	h0(m)	h1(m)	Resistance MRx	Fall Mx		JUDG	JUDGMENT
	$(N+W)/(d\times d)$	(b-t)/2	$Qx/(d \times q's)$	(h-h0)/2	MRy(N·m)	My(N·m)	My/Mry	MR	MR≧M
hort term earthquake X	0.058	0.421	0.001	0.275	12,149	251.3	0.021	<1.0	ş
hort period blow down + Holizontal X	690'0	0.416	900'0	0.272	13,110	1710.8	0.130	0.130 < 1.0	ð
hort period blow up+Holizontal X	0.039	0.431	900'0	0.272	10,483	1710.8	0.163	V1.0	ÖK



Resistance moment  $M_R=(N+W) \times e+q$ 's  $\times b \times h_1 \times h_1/2$ 

M=M' +Q\*(h/2) Fall moment

u	0.5	0.60 m	0.45 m	0.55 m	0.45 m
Base Foundatio	Lateral Pressure	=q	#6	<u>-</u> 4	h <sub>1</sub> =
2)					

0.60 m	0.45 m	0.55 m	0.45 m	0.35 m	0.10 m	50 KN/m <sup>2</sup>	100 KN/m <sup>2</sup>	22.5 KN/m <sup>3</sup>	15000 KN/m <sup>3</sup>
=9	110	=4	= lq	<u>II</u>	Concrete floor thickness t=	Endurance strength of ground Fe=	Short Term Permissible Endurance strength of ground q=	No line concrete Volume weight $\gamma$ =	Concrete standard strength Fc=

THE G

(Y断面)

X

h1

1		
<del></del>	X	р
A d		1: 綠端距離
		90мт)

NO

	Spindle Force(N)	Shear power(N)	wer(N)	Moment(Nm)	(mN)		Found	Foundation size(m)			Base Weight	Endurance strength of ground	Lateral Pressure
	z	Qx	Qy	M,×	M'y	q	р	h h	nd part lengtloor thicknes	hicknes	(N)M	q'(kN/m2) i	is(kN/m2)=0.5c
Long period load	434.2	0.0	0.0	528.4	0.0	09.0	0.45	0.55	0.35	0.10	3,341	20	25.0
Short period load	3948.7	0.0	0.0	5812.1	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0
Short term earthquake X	434.2	99.5	0.0	528.4	224.0	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0
Short term earthquake Y	434.2	0.0	99.5	752.3	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0
Short period blow down + Holizontal >	2921.5	677.5	0.0	4267.9	1524.5	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0
Short period blow down + Holizontal \	2921.5	0.0	738.0	5928.4	0.0	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0
Short period blow up+Holizontal X	-3711.4	677.5	0.0	-5704.1	1524.5	09.0	0.45	0.55	0.35	0.10	3,341	100	20.0
Short period blow up+Holizontal Y	-3711.4	0.0	-738.0	-7364.7	0.0	09:0	0.45	0.55	0.35	0.10	3,341	100	20.0

Examination	₽	Adminiation of substituting (SHOL period Show	(wous poi
subsidence load	-	Endurance strength of ground	
(N) M+N	1	(N) bxpxq	
7290	/	27000 OK	

94500 .. OK! 55973

nare force		force bearing capacity
(N) Ø	1	$f_c \times b \times 0.875t/2(N)$
55973	/	262500OK!

				X direction				
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		JUDG	JUDGMENT
	N+W(N)	$(N+W)/(b \times q')$	(d-t)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MR	MR≧M
Long period load	3775.5		0.162	2,131	132.1	0.062	<1.0	Š
Short period load	7290.0		0.164	4,235	1453.0	0.343	V1.0	ð
Short term earthquake X	3775.5	0.063	0.194	3,768	132.1	0.035	V1.0	ŏ
Short term earthquake Y	3775.5		0.194	3,768	190.6	0.051	<1.0	ÖK
Short period blow down + Holizontal >	× 6262.8		0.173	4,120	1067.0	0.259	<1.0	OK
Short period blow down + Holizontal Y	6262.8		0.173	4,120	1500.6	0.364	<1.0	Š
Short period blow up+Holizontal X	0.0	0.000	0.225	3,038	-1426.0	0.469	V1.0	ok
Short period blow up+Holizontal Y	0.0	0.000	0.225	3,038	-1859.6	0.612	V1.0	ð

				Y direction				
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		JUDGMENT	L
	N+W(N)	$(N+W)/(b \times q')$	(d-t)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MR≧M	
Short term earthquake X	3775.5	0.084	0.258	4,012	58.5	0.015	<1.0 OK!	
Short period blow down + Holizontal X	6262.8		0.230	4,481	398.1	0.089	0.089 < 1.0 OK	
Short period blow up+Holizontal X	0.0	0.000	0.300		398.1	0.131	<1.0 OK !	

5030 Post.

#### AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Mem	ber	bear

T only

	Dundust		Tension C		Tension Compression Shear			Bearing			Modulus of E						
Alloy and tamper Product		Ftu		Fty		Fcy	11 12 12 12 12 12 12 12 12 12 12 12 12 1	Fsu		Fsy		Fbu		Fby		E	
6063 T6	Extrusions		207		172	43.00	172		131		96		434		276		70000
							180										

Table 3.3(D) Page 20

Type of member stress		Intercept		Slope	Intersection		
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591	
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145	
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error	
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674	
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952	
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859	
Ultimate strength of flat plates in compression							
Illtimate strongth of	k1	0.35	k2	2.27			
Ultimate strength of flat plates in bending	k1	0.5	k2	2.04			

Table 3.4 (A) Page 21
-----------------------

Factor of safety	Normal buildings
фу	0.95
φυ	0.85
φνρ	0.9
φb	0.85
фср	0.8
φw	0.9
φс	0.85
φν	0.8
φcc 5	see below

RHS/SHS section properties

Effective Length (m)

2750 mm between restraints

Height Width 150 mm 95 mm

Walls side (avg if

complex shape)

1.6 mm

Walls top/bottom (average is complex

shape)

5.6 mm 6621600 CM (CANTAPORT) 662.16 Table 3.4 (b) Page 21

kt	1
kc	1.12

ly	1885900	188.59
J (Torsion constant		
(warp))		
•	3402000	340.2
Zx	88290	88.29
Zy	39700	39.7
Area .	1592	15.92
Radius of gyration		
Rx	64.49260797 mm	
Radius of gyration		
Ry	34.41817184 mm	

# Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 191.7113041

Zc 88290 Assumed to be Zx

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<: 142.9393882 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 1196.855281 mPa

#### MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 26.5842941 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 26.5842941 Rye 103.444537

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1 = 1

ky 1 rye 103.4445372

S1 -2.570688695 S2 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 142.9393863 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 1196.855042 mPa

3.4.22 Compression in components of bea- flat plates with both edges

WEBB

supported Page 41

NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 138.8 **S1** 38.36639146 **S2** 90.53212769

Equ-3.4.22(1): N<S1 190.06 Equ-3.4.22(2): S1<N<! 140.396174

Equ-3.4.22(3): S2>N 140.5560979

Add tripple to one formula

140-50 + 80200

FLANGE

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 16.39285714

н 91.8 Add tripple to one formula

**S1** 12.41378457 **S2** 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<! 156.9032732 mPa Equ-3.4.17(3): S2>N 257.1171799 mPa

#### Compression capacity

#### 3.4.8.1-Genreal compression

	K	1
Dc	62.79993051	
S1	0.581870399	
S2	1.241183988	
λχ	0.672716031	
λγ	1.260532124	
	X-X	у-у
φcc limits λ<1.2	0.858729633	0.73528825
φcc limits λ>1.2	0.674180244	0.7564745
	X-X	Y-Y
Equ-3.4.8.1 (1) N <s1< td=""><td>131.8763366</td><td>112.919268 mPa</td></s1<>	131.8763366	112.919268 mPa

103.5348232 116.172869 mPa Equ-3.4.8.1 (2) s1<n<: 126.9771987 81.581349 mPa

and choise 99.68855795 83.9319949 mPa the correct Equ-3.4.8.1 (3) N>s2 326.37835 79.5936167 mPa

256.2364535 81.886989 mPa

81.58-1592

one.

Red through

#### 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22 86.75

\$1 23.13644439 \$2 39.37218

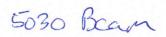
Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 42.02948511 mPa Equ-3.4.17 (3) N>s2 48.5865729 mPa

Flange

H/t See3.4.17 16.39285714

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 156.9032732 mPa Equ-3.4.17 (3) N>s2 257.1171799 mPa



#### AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Member T only beam

	Product		Tension		Compression	or	Shear			Bea	ring		Modu	ulus of E
Alloy and tamper	Ftu	Fty		Fcy	Fsu	Fsv		Fbu		Fby		E		
6063 T6	Extrusions	MARIE	207	172	17	2	131	96		434	1	276		70000
					18	0								

Table 3.3(D) Page 20

Type of member stress		Intercept		Slope	Intersection		
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	CC	78.6732591	
Compression in flat plates	Вр	216.080333		1.20053227		73.7947145	
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error	
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674	
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952	
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881		98.6818859	
Ultimate strength of flat plates in compression	k1	0.35	<i>k</i> 2	2.27			
Ultimate strength of flat plates in bending	k1	0.35		2.27			

Tah	۵	21	111	Page	21
IUN	10	J.4	171	rage	~1

Factor of safety	Normal buildings
φγ	0.95
φu	0.85
фvр	0.9
φb	0.85
фср	0.8
φw	0.9
фс	0.85
	0.00
ρν	0.8
pcc se	ee below

RHS/SHS section properties

Effective Length (m)

3000 mm between restraints

Height Width

124 mm 67 mm

Walls side (avg if complex shape)

1.5 mm

Walls top/bottom (average is complex

shape)

lx

3.8 mm 2317000 CM (CANTAPORT)

231.7

Table 3.4 (b) Page 21

kt	1
kc	1.12

ly	607500	60.75		
J (Torsion constant				
(warp))	1273000	127.3		
Zx	37370	37.37		
Zy	18130	18.13		
Area	906	9.06		
Radius of gyration				
Rx	50.57069451 mm			
Radius of gyration				
Ry	25.89459019 mm			

# Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 254.9687796

Zc 37370 Assumed to be Zx

\$1 1.792654179 \$2 2417.766287

mpa

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<5 140.0804637 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 899.916794 mPa

#### MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 30.69981192 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 30.69981192 Rye 97.7204684

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1 = 1

ky 1 rye 97.72046837

S1 -2.570688695 S2 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 140.0511658 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 897.4709285 mPa

3.4.22 Compression in components of bea- flat plates with

WEBB

both edges supported Page 41

NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 77.6 116.4 S1 38.36639146 S2 90.53212769

Equ-3.4.22(1): N<S1 190.06 Equ-3.4.22(2): S1<N<! 154.0168614

Equ-3.4.22(2): S1<N<: 154.0168614 Add tripple to one formula Equ-3.4.22(3): S2>N 157.1294007

No.03+37570

FLANGE

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 16.84210526

H 64 Add tripple to one formula S1 12.41378457

\$1 12.41378457 \$2 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<5 156.169775 mPa Equ-3.4.17(3): S2>N 250.2588087 mPa

# Compression capacity

### 3.4.8.1-Genreal compression

	K	1	
Dc	62.79993051		
S1	0.581870399		
S2	1.241183988		
λχ	0.935904121		
λγ	1.827768697		
	X-X	у-у	
φcc limits λ<1.2	0.803460135	0.61616857	
φcc limits λ>1.2	0.711026577	0.83588762	
	X-X	Y-Y	
Equ-3.4.8.1 (1) N <s1< td=""><td>123.3885207</td><td>94.6258881 mP</td><td>a</td></s1<>	123.3885207	94.6258881 mP	a
	109.1933672	128.368456 mP	a Red through
Equ-3.4.8.1 (2) s1 <n<s< td=""><td>105.524956</td><td>46.4154254 mP</td><td>a and choise</td></n<s<>	105.524956	46.4154254 mP	a and choise
	93.38490487	62.9666636 mP	a the correct
Equ-3.4.8.1 (3) N>s2	157.7720474	31.7238232 mP	a one.
	139.621263	43.0361952 mP	a

1

46.45+

#### 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22 77.6

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 56.96890871 mPa Equ-3.4.17 (3) N>s2 54.31553092 mPa

Flange

H/t See3.4.17 16.84210526

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 156.169775 mPa Equ-3.4.17 (3) N>s2 250.2588087 mPa



# AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Member beam

T only

Product		Tension		Compress	ior	Sh	ear		Bea	ring		Modulus of	
Alloy and tamper	Froudct	Ftu	Fty		Fcy	Fsu		Fsv	Fbi		Fbv	$\neg$	F
6063 T6	Extrusions		207	172	1	72	131		96	434	,	276	7000
					1	80							

Table 3.3(D) Page 20

Type of member		Intercept		Slope		ntersection	
stress				- interse			
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591	
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145	
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error	
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674	
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952	
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881		98.6818859	
Ultimate strength of flat plates in compression							
Ultimate strength of lat plates in pending	k1 k1	0.35		2.27			

Table 3.4 (A) Page 21

Factor of safety	Normal buildings
φу	0.95
φu	0.85
фур	0.9
φb	0.85
фср	0.8
φw	0.9
рс	0.85
004	0.8
pv pcc se	ee below

RHS/SHS section properties

Effective Length (m)

2750 mm between restraints

Height Width 150 mm 95 mm

Walls side (avg if complex shape)

1.6 mm

Walls top/bottom (average is complex

shape)

4.4 mm 5636200 CM (CANTAPORT) 563.62 Table 3.4 (b) Page 21

kt	1
kc	1.12

ly	1736200	173.62
J (Torsion const	tant	
(warp))	3296000	329.6
Zx	75150	75.15
Zy	36150	36.15
Area	1390	13.9
Radius of gyrati	ion	
Rx	63.67746967 mm	
Radius of gyrati	on	
Ry	35.34211013 mm	

# **Bending** capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 172.7818807

Zc 75150 Assumed to be Zx

**S1** 1.792654179 **S2** 2417.766287 mpa

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<5 143.8843872 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 1327.97887 mPa

### MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 25.24110667 Note Clause Ry=Rye Page 37 Bottom Para

25.24110667 Rye 108.949264

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1 = 1

ky rye 108.9492642 S1 -2.570688695 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<5 143.882019 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 1327.623817 mPa

138,134

3.4.22 Compression in components of bea- flat plates with

WEBB

both edges supported Page 41

NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 88.25 141.2 \$1 38.36639146

\$1 38.36639146 \$2 90.53212769

Equ-3.4.22(1): N<S1 190.06

Equ-3.4.22(2): S1<N<: 138.1632744 Add tripple to one formula

Equ-3.4.22(3): S2>N 138.1670424

FLANGE

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 20.86363636

H 91.8 Add tripple to one formula

S1 12.41378457 S2 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<5 149.6037251 mPa Equ-3.4.17(3): S2>N 202.0206414 mPa

# Compression capacity

# 3.4.8.1-Genreal compression

	k	
Dc	62.79993051	
S1	0.581870399	
S2	1.241183988	
λχ	0.681327501	
λγ	1.227578407	
	X-X v-v	

 $\phi$  cc limits  $\lambda$ <1.2 0.856921225 0.74220853  $\phi$  cc limits  $\lambda$ >1.2 0.67538585 0.75186098

X-X Y-

Equ-3.4.8.1 (1) N<s1 131.5986167 113.982025 mPa 103.7199698 115.464364 mPa Red through 126.2463732 83.8851586 mPa and choise 99.50157799 84.9760874 mPa the correct

1

one.

Equ-3.4.8.1 (3) N>s2 317.5100739 84.7141406 mPa 250.2468196 85.8158503 mPa 8385+ (7)90

#### 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22

88.25

23.13644439

**S2** 

39.37218

Equ-3.4.17 (1) N<s1

163.4

mPa

Equ-3.4.17 (3) N>s2

Equ-3.4.17 (2) s1<n<s 39.58039927 47.7607388

mPa mPa

Flange

H/t See3.4.17

20.86363636

**S1** 

23.13644439

**S2** 

39.37218

Equ-3.4.17 (1) N<s1

163.4

mPa

Equ-3.4.17 (2) s1<n<s 149.6037251

mPa

Equ-3.4.17 (3) N>s2 202.0206414

mPa



## AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Member	beam
Tonly	

Pro	Product		Tensi	on	Compressio	r	Sh	ear		Be	aring		Mod	ulus of E
Alloy and tamper	Troudet	Ftu	F	ty	Fcy	Fsu		Fsy		Fbu	Fbv		E	
6063 T6	Extrusions		207	172	173		131		96	43		276	_	70000
					180	)								

Table 3.3(D) Page 20

T5,T6,T7,T8 & T9 on	ly					
Type of member stress		Intercept		Slope		Intersection
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859
Ultimate strength of flat plates in compression						
Ultimate strength of flat plates in bending	k1	0.35		2.27		
	k1	0.5	k2	2.04		

Table	3.4	(A)	Page	21

Factor of safety	Normal buildings
фу	0.9
φu	0.85
φνρ	0.9
φb	0.85
and the second	0.0
фср	0.8
φw	0.9
φς	0.85
φν φcc s	0.8 ee below

RHS/SHS section properties

Effective Length (m)

3300 mm between restraints

Height

124 mm

Width

67 mm

Walls side (avg if complex shape)

1.5 mm

Walls top/bottom (average is complex

shape)

3.8 mm 2317000 CM (CANTAPORT)

231.7

Table 3.4 (b) Page 21

1
1.12

ly	607500	60.75
J (Torsion constant		
(warp))		
	1273000	127.3
Zx	37370	37.37
Zy	18130	18.13
Area	906	9.06
Radius of gyration		
Rx	50.57069451 mm	
Radius of gyration		
Ry	25.89459019 mm	

# **Bending** capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 280.4656576

37370 Assumed to be Zx

**S1** 1.792654179 2417.766287

Equ-3.4.15(1): N<S1

163.4 mPa Equ-3.4.15(2): S1<N<! 139.030319 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 818.1061763 mPa

MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 32.20569216 Note Clause Ry=Rye Page 37 Bottom Para

32.20569216 Rye 102.466359

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1 = 1

ky

rye 102.4663585

S1 -2.570688695 **S2** 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 138.9943573 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 815.504843 mPa

738. at

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

NOTE AMMEND SIDE WALLS FOR ODD SHAPES

 Limit (N) (h/t)
 77.6

 116.4

 S1
 38.36639146

 S2
 90.53212769

Equ-3.4.22(1): N<S1 190.06 Equ-3.4.22(2): S1<N<5 154.0168614 Equ-3.4.22(3): S2>N 157.1294007

Add tripple to one formula

#### **FLANGE**

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 16.84210526 H 64

Add tripple to one formula

\$1 12.41378457 \$2 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<: 156.169775 mPa Equ-3.4.17(3): S2>N 250.2588087 mPa

# Compression capacity

# 3.4.8.1-Genreal compression

	k	1
Dc	62.79993051	
S1	0.581870399	
S2	1.241183988	
λχ	1.029494533	
λγ	2.010545567	
	X-X y-y	
φcc limits λ<1.2	0.783806148 0.57778	8543

 $\begin{array}{llll} \phi cc \ limits \ \lambda < 1.2 & 0.783806148 & 0.57778543 \\ \phi cc \ limits \ \lambda > 1.2 & 0.724129235 & 0.86147638 \end{array}$ 

X-X Y-Y

Equ-3.4.8.1 (1) N<s1 120.3702299 88.731334 mPa

111.205561 132.298158 mPa Equ-3.4.8.1 (2) s1<n<: 98.33683986 36.89202 mPa

90.84973466 55.0058934 mPa

Equ-3.4.8.1 (3) N>s2 127.2005601 24.5848291 mPa 117.515848 36.6559079 mPa Red through and choise the correct

one.

96° gc

#### 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22 77.6

S1 23.13644439 S2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 56.96890871 mPa Equ-3.4.17 (3) N>s2 54.31553092 mPa

Flange

H/t See3.4.17 16.84210526

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 156.169775 mPa Equ-3.4.17 (3) N>s2 250.2588087 mPa



3. 5,700 SERIES

# STATIC REPORT

PJR-series

5730-H23

## 1. Material and Evaluation

#### (1)Post

Materi A6063S-T6(SS)

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8389	15.92	662.16	188.59	88.29	39.70	70000	3.44	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb + \sigma c/fc =$ 

0.69 < 1.0 OK!

Wind blow up

 $\sigma b/fb + \sigma c/fc =$ 

0.70 < 1.0 OK!

Wind blow down

 $\sigma b/fb + \sigma t/ft =$ 

0.78 <1.0 OK!

2 · lk/i=

118.5 < 140 OK!

#### 2Beam

Materi A6063S-T6(SS)

Material performance

Material	Cross-section area	ection area Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8394	10.83	267.79	73.78	43.16	22.02	70000	2.61	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb=$ 

0.73 <1.0 OK!

Wind blow up

 $\sigma$  bx/fbx=

0.54 < 1.0 OK!

Wind blow down

 $\sigma$  bx/fbx=

0.72 <1.0 OK!

## 3 Main frame

Materi A6063S-T6(SS)

Material performance

iai per	Torritario	JE							
Mat	Material Cross-section area Second section moment		ion moment	Section factor		Elasticity factor	Cross-section radius	F value	
IVIA	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8	8580有	1.93	6.61	2.23	2.83	0.97	70000	1.08	180

Material evaluation

 $\sigma b/fb=$ 

0.58 < 1.0 OK!

## 4Front frame

Materi A6063S-T5

Material performance

	Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
1	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
	DE8401	2.55	12.50	6.91	3.81	2.20	70000	1.65	132

Material evaluation

 $\sigma b/fb=$ 

0.34 < 1.0 OK!

## **5**Rear frame

Materi A6063S-T5

Material performance

Mate	rial	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
iviate	riai	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE840	04有	2.55	7.70	5.90	2.34	1.82	70000	1.52	132

Material evaluation

 $\sigma b/fb=$ 

0.47 < 1.0 OK!

#### **6**Rafter

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Iviaterial	(cm2)	Ix(cm4)	ly(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8654+DE8666	1.88	0.36	3.75	0.53	1.48	70000	1.41	132

Material evaluation

 $\sigma b/fb=$ 

0.47 < 1.0 OK!

(7)Side frame

Materi A6063S-T5

Material performance

Material Cross-section are	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Waterial	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8683+DE8412	1.65	0.40	2.00	0.32	0.93	70000	1.10	132

Material evaluation

 $\sigma b/fb=$ 

0.33 < 1.0 OK!

®Corner bracketMateri SPFH590Material performance

F value Second section moment Section factor Cross-section area Elasticity factor Cross-section radio Material (cm2) Ix(cm4) Iy(cm4) Zx(cm3) Zy(cm3) E(N/mm2) i cm N/mm2 65.07 GB8064 8.58 205.21 20.34 210000 2.75 420 28.12

Material evaluation (without support and side panel Vex=38m/s)

 $\sigma$  bx/fb=

0.69 < 1.0 OK!

 $\sigma$  by/fb=

0.08 < 1.0 OK!

## 9 Main frame connecting parts

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8086	2.77	5.59	1.85	2.87	1.69	70000	0.82	132

Material evaluation

 $\tau$  /fs=

0.02 < 1.0 OK!

## **10**Front frame connecting parts

Materi A6063S-T5

Material performance

ar portorman	00							
Material	Cross-section area	Second section moment		Section	factor	Elasticity factor	Cross-section radius	F value
Wateriai	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8084	2.62	6.94	4.75	2.95	2.26	70000	1.35	132

Material evaluation

τ /fs=

0.01 < 1.0 OK!

## ①Rear frame connecting parts

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8085	1.92	2.92	1.83	1.78	1.40	70000	0.98	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

12Roof material

Material

polycarbonat

 $\max \sigma x =$ 

Material performance

Material	Thickness	Length(short part)	Length(long part)	Inserting	Poisson ratio	Elasticity factor	F value
Waterial	cm	cm	cm	cm	ν	kgf/cm2	kgf/cm2
GB4107	0.18	70.3	296.2	1.89	0.3	21000	551

Material evaluation

Bending volume : Wmax=

1.82 cm

44.44 kgf/cm<sup>2</sup>

<

<

551.0 kgf/cm<sup>2</sup>

∴ok!

Necessary depth of insert  $\Delta L$ 

0.31 cm depth or

1.89 cm

..ok!

13Roof retainer

Materi A6063S-T5

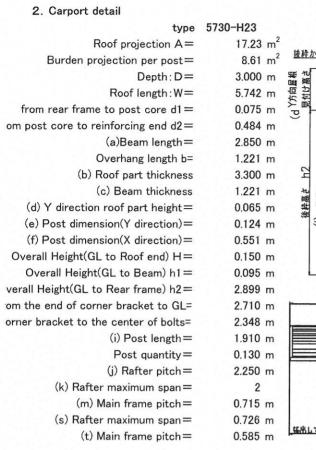
Material performance

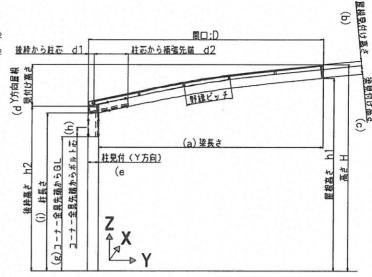
Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Waterial	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8411	0.79	0.03	1.84	0.08	0.72	70000	1.52	132

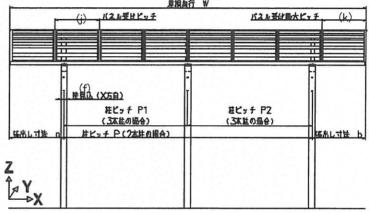
Material evaluation

 $\sigma b/fb=$ 

0.18 < 1.0 OK!







#### 3. Load design

1) Vertical over load (G)

Part Weight

 Roof
 60.0 N/m²

 Post
 42.1 N/m

2 Snow over load

Post quantity	Snow area	Snow quantity	Unit weight	Short period snow period
2 posts type	General area	20 cm	$30 \text{ N/m}^2/\text{cm}$	600 N/m <sup>2</sup>

## 3 Wind blowing load(Vex=38m/s)

· For design of structure frame

Speed pressureq=0. 6E(Vex•y)²= 708 N/m²
Standard wind speedVex= 38 m/s

 $E=Er^{2}Gf=$  1.194  $Er=1. 7(Zb/Z_{G})^{\alpha}=$  0.691

Ground surface Div.

Gust influence factor Gf= 2.5

Zb = 5  $Z_G = 450$   $\alpha = 0.2$ 

Installation period factor y= 0.827

· For roof material design

Average speed pressureq' = 0.  $6Er2(Vex-y)^2$  = 283 N/m<sup>2</sup>

4 Earthquake power

Earthquake power Qi=Z·Rt·Ai·Co·Wi

#### 4. Preparing calculation

#### 4-1 Carport load (For earthquake power calculation)

Earthquake power Qi=Z·Rt·Ai·Co·Wi=

183.5 N

#### 4-2 Wind pressure power calculation (Maximum wind power pressure for 1 post)

#### ·For design of structure frame

Wind factor

Independent shed

10°

C=

0.60 (+pressure)

-1.00 (-pressure)

1.2 (Post flat power, side panel)

Wind pressureW=q C=

425 N/m<sup>2</sup>

(Wind blow down)

 $-708 \text{ N/m}^2$ 

(Wind blow up)

849 N/m<sup>2</sup>

(Flat)

#### ·Roof material design

Peak with factor calculation process Gpe=

3.1 (+pressure)

3.0 (-pressure: panel center part)

4.0 (-pressure: panel surrounding part)

Peak wind factor Cf=

3.1 x 0.60

1.86 -3.00

3.0 x -1.00 4.0 x -1.00

-4.00

Wind pressure W=q' Cf=

527 N/m<sup>2</sup>

(Wind blow down)

-849 N/m<sup>2</sup>

(Wind blow up)

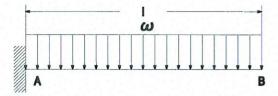
=

 $-1132 \text{ N/m}^2$ 

(Wind blow up)

## 5. Beam material examination

## 5-1 Beam load(without support Vex=38m/s)



## Load chart

Туре				
Vertical load width (m)	Total/post q	uantity		2.871
I (m)	D-d1-d2			2.441
Load	Long period I	oad		172.3
ω(N/m)	Short period	load		1894.9
	Short period blowin	g down(vertical)		1391.4
	Short period blowin	g up(vertical)		-1859.6
	Short period blowin	g down(horizontal)		133.8
	Short period earthq	uake(vertical)		172.3
	Short period earthq	uake(horizontal)		51.7
	Long period I	oad		513.2
	Short period	load		5645.2
Bending moment	Short period blowin	g down(vertical)		4145.3
M(N·m)	Short period blowin	g up(vertical)		-5540.3
	Short period blowin	g (horizontal)		398.5
	Short period earthq	uake(vertical)		513.2
	Short period earthq	uake(horizontal)		154.0
Maximum bending mon	maxMx	(long period)		
(N·m)		(short period)		5645.2
	maxMy	(long period)		
		(short period)		398.5
Second section mome				267.8
	Iy(cm <sup>4</sup> )			73.8
Section factor	Zx(cm <sup>3</sup> )			43.2
	Zy(cm <sup>3</sup> )			22.0
Elasticity factor	E(N/cm²)			7000000
Maximum bending stre	maxσx			130.8
(N/mm2)	max σ y			18.1
Vertical maximum defo	max δ x	(cm)		4.49
	max δ x ∕ I	1/	128	
Flat maximum deforma	NAME AND ADDRESS OF THE PARTY O	(cm)		1.15
	max δ y ∕ I	1/	500	

## 5-2 Beam permissible stress degree Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
b λ ≦b λ p	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	12.40	cm			
t=	0.49	cm			
t1=	0.20	cm			
b=	6.70	cm			
Young's modulus factor E=	70000	N/mm <sup>2</sup>			
Shear elasticity factor of bending materialG=	27000	Nmm			
Torsion fixed number of bending material=	164.6	cm <sup>4</sup>			
Second section moment around weak axis ly=	73.775	cm <sup>4</sup>		J	
Section factor of bending direction Z=	43.163	cm <sup>3</sup>		1	
F: Standard strength(N/mm2) =	180	N/mm <sup>2</sup>			
b $\lambda = \sqrt{My/Me}$	0.13			1 1	
$Me=C\sqrt{((\pi^2EIyGJ)/lb^2)}=$	450473362	Nmm			
Bending moment My=	7769340	Nmm			
$C=1.75+1.05(M2/M1)+0.3(M2/M1)^2=$	1.75				
M2=	0	Nm			
M1=	5540	Nm		1	
M2/M1=	0				b
lb=	584.7	mm			
b $\lambda$ p=0.6+0.3(M2/M1)=	0.6				
bλe=1/√0.5=	1.41				
$\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$	(its value as	sumes 2.17 in cas	e more than	n 2.17)	

 $\nu$  = 1.51  $b\lambda \leq b\lambda p$ 

119.5 N/mm<sup>2</sup> Permissible stress degree fb:  $F/\nu =$ 

#### Permissible stress degree at bend parts (strong axis) 1) Frange plate of beam <top/bottom face> $\Gamma$ b : The conversion ratio = b/t • $\sqrt{(F/E)}$ 0.65 Гь = a) Γb ≦ 1.34 fb = F/1.5b) $1.34 < \Gamma b \le 2.69$ $fb = F - 0.248F \Gamma b$ $fb = 2.41 F/(\Gamma b^2)$ c) $2.69 < \Gamma b$ 120.0 N/mm<sup>2</sup> 2) Web plate of beam (side face) $\Gamma d$ : The conversion ratio = $d/t \cdot \sqrt{(F/E)}$ 2.90 a) Γd ≤ 3.29 fb = F/1.5b) $3.29 < \Gamma d \le 6.57$ $fb = F - 0.101F\Gamma$ c) $6.57 < \Gamma d$ fb = 14.4 F/( $\Gamma d^2$ ) 120.0 N/mm<sup>2</sup> Therefore, result data is... fbx= 119.5 N/mm<sup>2</sup> 179.3 N/mm<sup>2</sup> fbx= Permissible stress degree at bend parts (weak axis) 1) Frange plate of beam <top/bottom face> $\Gamma b := b/t \cdot \sqrt{(F/E)}$ Гь = 2.90 a) Γb ≦ 1.34 fb = F/1.5b) $1.34 < \Gamma b \le 2.69$ $fb = F - 0.248F \Gamma b$ c) $2.69 < \Gamma b$ $fb = 2.41 F/(\Gamma b^2)$ 51.7 N/mm<sup>2</sup> 2) Web plate of beam <side face> $\Gamma d$ : The conversion ratio = $d/t \cdot \sqrt{(F/E)}$ 0.65 a) Γd ≦ 3.29 fb = F/1.5b) $3.29 < \Gamma d \le 6.57$ $fb = F - 0.101F\Gamma$ c) $6.57 < \Gamma d$ fb = $14.4 \, \text{F}/(\Gamma \, \text{d}^2)$ 120.0 N/mm<sup>2</sup> fb= Therefore, result data is... 51.7 N/mm<sup>2</sup> fby= 77.6 N/mm<sup>2</sup> Section of the Beam examination Snow for short period M= 5645.2 N·m 130.8 N/mm<sup>2</sup> σb= 0.73 < 1.0 OK! $\sigma b/fb=$ Wind blow down 4145.3 N·m M= $\sigma bx =$ 96.0 N/mm<sup>2</sup> 0.54 < 1.0OK! $\sigma bx/fbx=$ Wind blow up -5540.3 N·m M= $\sigma bx =$ 128.4 N/mm<sup>2</sup> 0.72 < 1.0OK! $\sigma$ bx/fbx= Wind blow horizontal M= 398.5 $\sigma$ by= 18.1

0.23 < 1.0

 $\sigma$  by/fby=

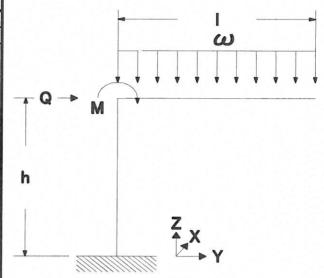
OK!

## 6. Post material examination

#### 6-1 Post load

## Load chart

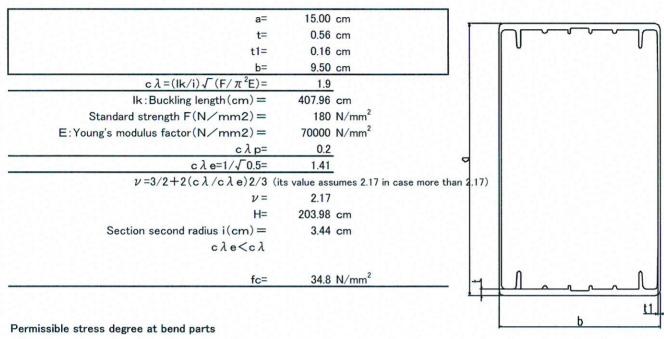
Туре		
Vertical load width (m)	Total/post quantity	2.871
I (m)	D-d1	2.850
	Long period load	172.3
Load	Short period load	1894.9
ω(N/m)	Short period blowing up(vertical)	1391.4
	Short period blowing down(vertical)	-1859.6
	Short period earthquake(vertical)	172.3
	Long period load	611.6
Axial force	Short period load	5779.4
by vertical load	Short period blowing up(vertical)	4269.0
N(N)	Short period blowing down(vertical)	-5484.1
	Short period earthquake(vertical)	611.6
Flat load	Short period wind X	637.4
Q(N)	Short period wind Y	1119.4
	Short period earthquakeX, Y	155.0
	Long period load	699.6
Bending moment	Short period load	7695.5
M(N·m)	Short period blowing up(vertical)	5650.8
	Short period blowing down(vertical)	-7552.5
	Short period earthquake(vertical)	699.6
Bending moment	Short period blowing up(vertical)+WindY	8169.4
by vertical and flat load	Short period blowing down(vertical)+WindY	-10071.1
Mx(N·m)	Short period earthquake(vertical) + Earthquak	
Bending moment	Short period windX	1434.2
by flat load	Short period earthquakeX	348.8
My(N·m)		
Maximum bending	maxMx (long period)	
moment(N·m)	(short period)	10071.1
	maxMy (short period wind)	1434.2
	(short period earthqual	348.8
Second section moment		662.155
	Iy(cm4)	188.59
Section factor	Zx(cm3)	88.287
	Zy(cm3)	39.70
Max. bending stress deg.		7.92
σx(N/mm2)	Short period load	87.16
	Short period blowing up(vertical)	64.01
	Short period blowing down(vertical)	-85.54
	Short period earthquake(vertical)	7.92
	Short period blowing up(vertical)+WindY	92.53
	Short period blowing down(vertical)+WindY	-114.07
	Short period earthquake(vertical) + Earthquak	11.88
max σ x (N/mm2)	Long period	7.92
(uniaxial bending)	Short period(Y direction Vertical load)	114.07
Bending stress degree	Short period windX	36.12
σy(N/mm2)	Short period earthquakeX	8.79



#### 6-2 Post permissible stress degree

Permissible pressure stress degree

	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
cλ≦cλp	F/ ν	Long period x 1.5
<b>cλp<cλ≦cλe< b=""></cλ≦cλe<></b>	$(1.0-0.5((c\lambda-c\lambda p)/(c\lambda e-c\lambda p)))F/\nu$	Long period x 1.5
cλe <cλ< td=""><td>(1/c λ<sup>2</sup>)·(F/ν)</td><td>Long period x 1.5</td></cλ<>	(1/c λ <sup>2</sup> )·(F/ν)	Long period x 1.5



#### 1) Frange plate of beam <top/bottom face>

 $\Gamma d := d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 0.83$ 

- a) Γd ≦ 1.34
- fb = F/1.5
- b)  $1.34 < \Gamma d \le 2.69$
- $fb = F 0.248F \Gamma d$
- c)  $2.69 < \Gamma d$
- $fb = 2.41 F/(\Gamma d^2)$

fc= 120.0 N/mm<sup>2</sup>

## 2) Web plate of beam <side face>

 $\Gamma d := d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 4.40$ 

- a) Γd ≦ 1.34
- fb = F/1.5
- b)  $1.34 < \Gamma d \le 2.69$
- $fb = F 0.248F \Gamma d$
- c)  $2.69 < \Gamma d$
- $fb = 2.41 \, F/(\Gamma \, d^2)$

fc= 22.4 N/mm<sup>2</sup>

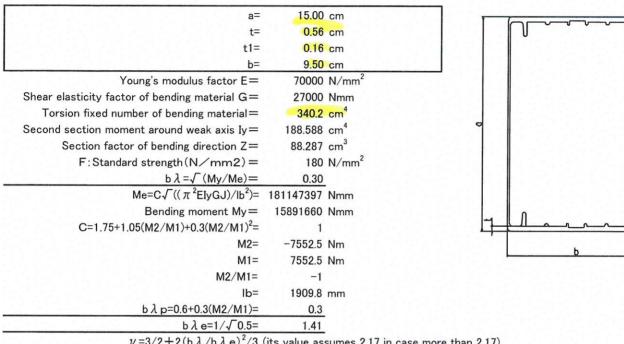
Therefore result date is a

	fc=	33.6 N/mm <sup>2</sup>	
	fc=	22.4 N/mm <sup>2</sup>	
Therefore, result date is***			

## 6-3 Permissible stress degree at bend parts

Permissible bending stress degree

	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
ьλ≦ьλр	F/ <i>ν</i>	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5



 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

1.53

ьλ≦ьλр

Permissble stress degree fb:  $F/\nu =$ 117.7 N/mm<sup>2</sup>

#### Permissible bending stress degree (strong axis)

#### 1) Frange plate (top/bottom face)

 $\Gamma$ b : The conversion ratio = b/t ·  $\sqrt{(F/E)}$ 

0.83  $\Gamma b =$ 

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma b$ 

c) 2.69 < \Gamma b

 $fc = 2.41 F/(\Gamma b2)$ 

fb=

2) Web plate <side face>

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

4.40

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma d$ 

c)  $6.57 < \Gamma d$ 

 $fb = 14.4 F/(\Gamma d^2)$ 

Therefore, result date is \*\*\*

100.0 N/mm<sup>2</sup> fbx= 150.0 N/mm<sup>2</sup> fbx=

100.0 N/mm<sup>2</sup>

120.0 N/mm<sup>2</sup>

#### Permissible bending stress degree (weak axis)

#### 1) Frange plate <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Гь= 4.40

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

F - 0.248F □ d fc =

c) 2.69 <  $\Gamma$ b

2.41 F/( $\Gamma d2$ ) fc =

> 22.4 N/mm<sup>2</sup> fb=

#### 2) Web plate (side face)

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

Γd= 0.83

a) Γd ≦ 3.29

fb =F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

fb =F - 0.101F \( \text{d} \)

c) 6.57 <  $\Gamma d$ 

 $14.4 \, \text{F}/(\Gamma \, \text{d}^2)$ fb =

> fb= 120.0 N/mm<sup>2</sup>

Therefore, result date is ...

22.4 N/mm<sup>2</sup> fby= fby= 33.6 N/mm<sup>2</sup>

#### Examination of the section of the post

Short period snow load

87.2 N/mm<sup>2</sup> σb=  $\sigma c=N/A=$ 3.6 N/mm<sup>2</sup> 0.69 < 1.0OK!  $\sigma b/fb + \sigma c/fc =$ 

Wind blow down

92.5 N/mm<sup>2</sup>  $\sigma b =$  $\sigma c=N/A=$ 2.7 N/mm<sup>2</sup> 0.70 < 1.0 OK!

 $\sigma b/fb + \sigma c/fc =$ 

 $\sigma b/fb + \sigma t/ft =$ 

Wind blow up  $\sigma b =$ 114.1 N/mm<sup>2</sup>  $\sigma t=N/A=$ 3.4 N/mm<sup>2</sup> 0.78 < 1.0 OK!

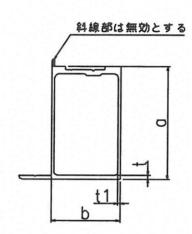
118.5 < 140 OK! 2 · lk/i=

#### 7. Main Frame Bending permissible stress degree

7-1 Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
ьλ≦ьλр	F/ <i>ν</i>	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	4.60	cm
t=	0.16	cm
t1=	0.09	cm
b=	2.50	cm
Young's modulus factor E=	70000	N/mm <sup>2</sup>
Shear elasticity factor of bending materialG=	27000	Nmm
Torsion fixed number of bending material=	3.6	cm <sup>4</sup>
Second section moment around weak axis ly=	2.234	cm <sup>4</sup>
Section factor of bending direction Z=	2.829	cm <sup>3</sup>
F: Standard strength(N/mm2) =	180	$N/mm^2$
b λ =√ (My/Me)=	0.29	
Me=C√(( $\pi$ 2EIyGJ)/lb2)=	6083883	Nmm
Bending moment My=	509220	Nmm
C=	1.13	
lb=	715	mm
	0.3	
$b \lambda p = 0.6 + 0.3 (M2/M1) =$	0.0	



 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17) 1.53

 $\nu =$ 

Ьλ≦Ьλр

117.8 N/mm<sup>2</sup>

0.41

#### Permissible stress degree at bend parts

## 1) Frange plate of beam (top/bottom face)

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

Гь =

a) Γb ≦ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c) 0.876 < \Gamma b

fb =  $0.256 \text{ F/}(\Gamma \text{ b}^2)$ 

 $\Gamma$ b : The conversion ratio = b/t ·  $\sqrt{(F/E)}$ 

fb=

0.74

120.0 N/mm<sup>2</sup>

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c) 2.69 <  $\Gamma$ b

 $fc = 2.41 \, F/(\Gamma \, d2)$ 

120.0 N/mm<sup>2</sup> fb=

#### 2) Wave plate of beam <side face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

2.41

a)  $\Gamma d \leq 3.29$ 

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

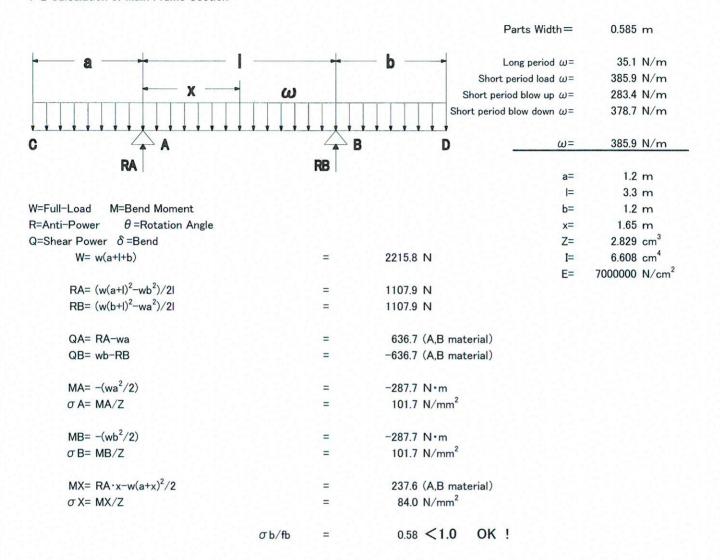
fb =  $14.4 \text{ F}/(\Gamma d^2)$ 

120.0 N/mm<sup>2</sup> fb=

Therefore, result data is...

fb= 117.8 N/mm<sup>2</sup> 176.7 N/mm<sup>2</sup> fb=

#### 7-2 Calculation of Main Frame Section

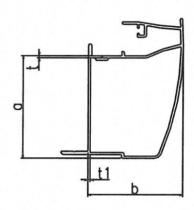


### 8. Front frame bending permissible stress degree

8-1 Bending permissible stress degree

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
ьλ≦ьλр	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

a=	4.77	cm	
t=	0.10	cm	
t1=	0.10	cm	
b=	4.20	cm	
Young's modulus factor E=	70000	N/mm <sup>2</sup>	
Shear elasticity factor of bending materialG=	27000	Nmm(アルミ材)	
Torsion fixed number of bending material=	8.4	cm <sup>4</sup>	
Second section moment around weak axis ly=	6.911	cm <sup>4</sup>	
Section factor of bending direction Z=	3.805	cm <sup>3</sup>	
F: Standard strength $(N/mm2) =$	132	N/mm <sup>2</sup>	
b $\lambda = \sqrt{\text{(My/Me)}}$	0.17		
Me=C√(( $\pi$ 2EIyGJ)/lb2)=	16407392	Nmm	
Bending moment My=	502260	Nmm	
C=	1.13		



lb= 715 mm b λ p=0.6+0.3(M2/M1)= 0.3 b λ e=1/√0.5= 1.41

 $\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$  (its value assumes 2.17 in case more than 2.17)

 $\nu = 1.51$ 

ьλ≦ьλр

fb= 87.4 N/mm<sup>2</sup>

#### Permissible stress degree at bend parts

## 1) Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

 $\Gamma b = 1.74$ 

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c)  $2.69 < \Gamma b$ 

 $fc = 2.41 F/(\Gamma d2)$ 

fb=  $75.1 \text{ N/mm}^2$ 

#### 2) Web plate of beam <side face>

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 1.98$ 

fb=

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

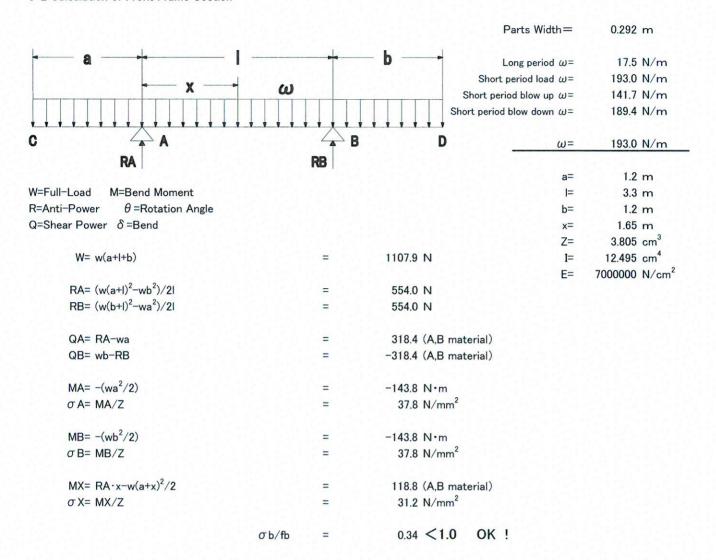
fb = 14.4 F/( $\Gamma d^2$ )

Therefore, result data is...

fb= 75.1 N/mm<sup>2</sup> fb= 112.7 N/mm<sup>2</sup>

88.0 N/mm<sup>2</sup>

#### 8-2 Calculation of Front Frame Section



#### 9. Bending permissible stress degree at rear frame

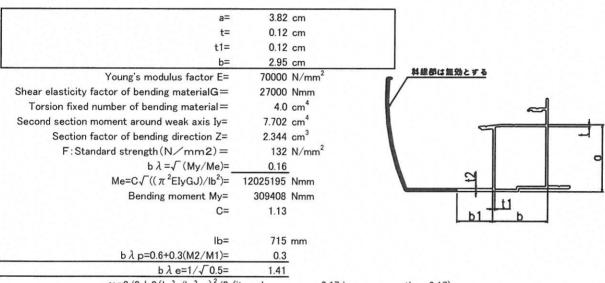
#### 9-1 Calculation method of effective section

t2= 1.70 mm b1= 17.15 mm

## 9-2. Bending permissible stress degree at rear frame

Bending permissible stress degree

bending permissible stress degre		
	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
bλ≦bλp	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5



 $\nu$  =3/2+2(b  $\lambda$  /b  $\lambda$  e)<sup>2</sup>/3 (its value assumes 2.17 in case more than 2.17)

 $\nu = 1.51$ 

b  $\lambda \leq b \lambda p$ fb= 87.5 N/mm<sup>2</sup>

## Permissible stress degree at bend parts

#### 1) Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

 $\Gamma b = 0.98$ 

a) Γb ≦ 1.34

fc = F/1.5

b) 1.34  $< \Gamma b \le 2.69$ 

 $fc = F - 0.248F\Gamma d$ 

c)  $2.69 < \Gamma b$ 

 $fc = 2.41 \, F/(\Gamma \, d2)$ 

fb=  $88.0 \text{ N/mm}^2$ 

#### 2) Web plate of beam <side face>

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 1.30$ 

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\,\Gamma$ 

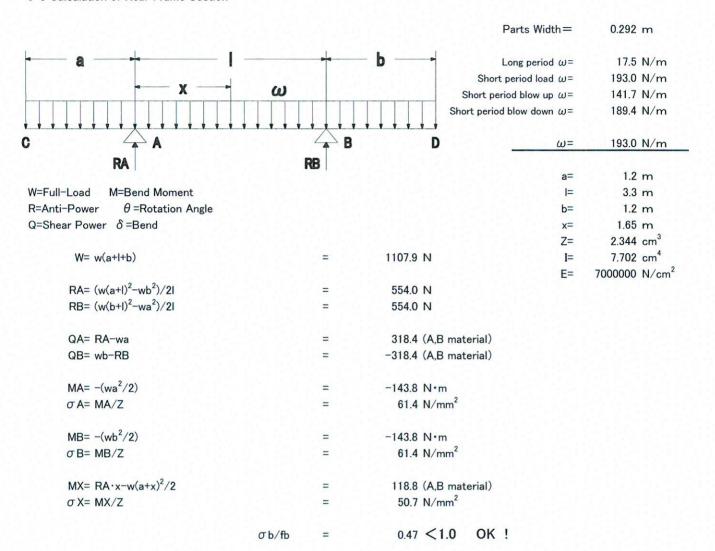
c)  $6.57 < \Gamma d$ 

fb = 14.4 F/( $\Gamma d^2$ ) fb= 88.0 N/mm<sup>2</sup>

Therefore, result data is...

fb= 87.5 N/mm<sup>2</sup> fb= 131.2 N/mm<sup>2</sup>

#### 9-3 Calculation of Rear Frame Section



#### 10. Rafter / Roof retainer bending permissible stress degree

10-1 Bending permissible stress degree

a=	1.30 cm
t=	0.10 cm
t1=	0.17 cm
b=	0.72 cm
b1=	1.99 cm
	2

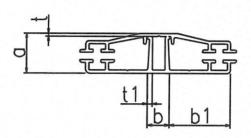
Young's modulus factor E= 70000 N/mm<sup>2</sup>

Shear elasticity factor of bending materialG= 27000 Nmm

Second section moment around weak axis Iy= 0.364 cm<sup>4</sup>

Section factor of bending direction Z= 0.529 cm<sup>3</sup>

F: Standard strength (N/mm2) = 132 N/mm<sup>2</sup>



Therefore···

 $fb = 88.0 \text{ N/mm}^2$ 

#### Permissible stress degree at bend parts

## Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t ·  $\sqrt{(F/E)}$ 

Γb = 0.86

a) Γb ≤ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c) 0.876 < Гь

 $fb = 0.256 F/(\Gamma b2)$ 

fb=  $45.3 \text{ N/mm}^2$ 

Therefore···

fb= 45.3 N/mm<sup>2</sup> fb= 68.0 N/mm<sup>2</sup>

				Parts Width=	0.715 m
				=	0.585 m
1 -		-1-	<del>-</del> 1 <del>-+</del> 1	Long period $\omega$ =	42.9 N/m
				Short period load ω=	471.9 N/m
				Short period blow up $\omega$ =	346.5 N/m
A	B 2 C	3	D 2 E 1	Short period blow down ω=	-463.1 N/m
Λ []	D 2 0	U		$\omega$ =	471.9 N/m
W=Full-Loa	d M=Bend Moment			Z=	0.529 cm <sup>3</sup>
R=Anti-Pov	wer $\theta$ =Rotation An	gle			
Q=Shear Pe	ower $\delta$ =Bend			I=	0.364 cm <sup>4</sup>
	ωΙ	=	275.9 N		
				E=	7000000 N/cm <sup>2</sup>
RA=	$0.395 * \omega 1$	=	109.0 N		
RB=	$1.131 * \omega$	=	312.1 N		
RC=	$0.974 * \omega 1$	=	268.7 N		
RD=	$0.974 * \omega 1$	=	268.7 N		
RE=	$1.131 * \omega$	=	312.1 N		
RF=	$0.395 * \omega 1$	=	109.0 N		
Rmax=			312.1 N		
MB=	$-0.105 * \omega 1^{2}$	=	-16.9 N•m		
MC=	$-0.079 * \omega 1^2$	=	-12.7 N⋅m		
MD=	$-0.079 * \omega 1^2$	=	-12.7 N•m		
ME=	$-0.105 * \omega 1^{2}$	=	-16.9 N•m		
M1=	$0.078 * \omega 1^{2}$	=	12.6 N·m		
M2=	$0.033 * \omega  ^{2}$	=	5.3 N⋅m		
M3=	0.046 * ωl <sup>2</sup>	=	7.4 N·m		
σ X=	MX/Z	=	32.0 N/mm <sup>2</sup>		
	$\sigma$ b/fb	=	0.47 < 1.0	ок !	

#### 11. Side frame bending permissible stress degree

#### 11-1 Calculation method of effective section

## 11-2 Bending permissible stress degree

a=	1.30 cm
t=	0.11 cm
t1=	0.17 cm
b=	0.72 cm
b1=	1.99 cm

70000 N/mm<sup>2</sup> Young's modulus factor E= 27000 Nmm ear elasticity factor of bending materialG= cond section moment around weak axis Iy= 2 cm<sup>4</sup> Section factor of bending direction Z=  $0.324 \text{ cm}^3$ F: Standard strength (N/mm2) =132 N/mm<sup>2</sup>

Therefore···

88.0 N/mm<sup>2</sup> fb =

## Permissible stress degree at bend parts

# Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

Гь= 0.79

a) Γb ≤ 0.438

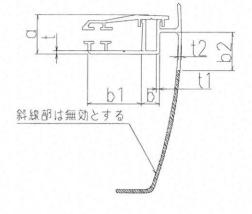
fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$  $fb = F - 0.760F \Gamma b$ c) 0.876 < Гь  $fb = 0.256 F/(\Gamma b2)$ 

53.2 N/mm<sup>2</sup> fb=

Therefore...

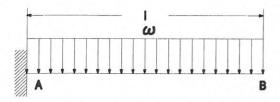
53.2 N/mm<sup>2</sup> fb= fb= 79.8 N/mm<sup>2</sup>



				Parts Width=	0.363 m
				<b>=</b>	0.585 m
- 1 -	- 1 -	- I	- I I	Long period $\omega$ =	21.8 N/m
				Short period load ω=	239.6 N/m
				Short period blow up $\omega$ =	175.9 N/m
	B 2 C		D 2 E 1	Short period blow down $\omega =$	-235.1 N/m
A 1	B 2 C	3	D 2 E 1	<u>ω=</u>	239.6 N/m
W=Full-Load R=Anti-Powe		ngle		Z=	0.324 cm <sup>3</sup>
	wer $\delta$ =Bend	.0		I=	0.399 cm <sup>4</sup>
	ωι	= 113	140.1 N		
				E=	7000000 N/cm <sup>2</sup>
RA=	$0.395 * \omega I$	=	55.3 N		
RB=	$1.131 * \omega I$	=	158.4 N		
RC=	$0.974 * \omega 1$	=	136.4 N		
RD=	$0.974 * \omega 1$	=	136.4 N		
RE=	1.131 * WI	=	158.4 N		
RF=	0.395 * ωI	=	55.3 N		
Rmax=			158.4 N		
MB=	$-0.105 * \omega 1^{2}$		-8.6 N•m		
MC=	$-0.079 * \omega 1^{2}$	=	-6.5 N⋅m		
MD=	$-0.079 * \omega 1^{2}$	= 1	-6.5 N⋅m		
ME=	$-0.105 * \omega 1^{2}$	= -	-8.6 N•m		
M1=	$0.078 * \omega 1^{2}$	=	6.4 N·m		
M2=	$0.033 * \omega 1^{2}$	= -	2.7 N·m		
M3=	$0.046 * \omega  ^{2}$	= 1	3.8 N·m		
σ X=	MX/Z	=	26.5 N/mm <sup>2</sup>		
	σb/fb	=	0.33 < 1.0	OK !	

#### 12. Corner bracket examination

## 12-1 Beam load



## Load chart

T			
Туре			
Vertical load width (m)	Total/post quantity		2.871
I (m)	D-d1-c	12	2.925
Load	Long period	load	172.3
ω(N/m)	Short period	d load	1894.9
	Short period blow	ing up(vertical)	1391.4
	Short period blow	ing up(vertical)	-1687.4
	Short period blow	ing down(horizontal)	160.5
	Short period earth	nquake(vertical)	172.3
	Short period earth	nquake(horizontal)	51.7
	Long period	load	736.9
	Short period	d load	8105.9
Bending moment	Short period blow	ing down(vertical)	5952.2
M(N·m)	Short period blow	ing up(vertical)	-7218.3
	Short period blowing (horizontal)		686.6
	Short period earthquake(vertical)		736.9
	Short period earth	nquake(horizontal)	221.1
Maximum bending momer	maxMx	(long period)	
(N·m)		(short period)	8105.9
	maxMy	(long period)	
		(short period)	686.6
Second section moment	Ix(cm <sup>4</sup> )		267.8
	Iy(cm <sup>4</sup> )		73.8
Section factor	Zx(cm <sup>3</sup> )	190 A 1 C 1 A 2 A 3 A 4 A 4 A 4 A 4 A 4 A 4 A 4 A 4 A 4	43.2
	Zy(cm <sup>3</sup> )		22.0
Elasticity factor	E(N/cm <sup>2</sup> )		21000000
Maximum bending stress degree	max σ x		187.8
(N/mm2)	max σ y		31.2
Vertical maximum deformation quantity	max δ x	(cm)	3.08
	max δ x∕I	1/	186
Flat maximum deformation quantity	max δ y	(cm)	0.95
	max δ y∕l	1/	606

## 12-2 Calculation of Corner bracket Section

Material	Second section moment		Section factor	
Iviaterial	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)
GB8064	205.211	65.073	28.119	20.335

fb= 420 N/mm<sup>2</sup> Mx= 8105.9 N·m My= 686.6 N·m

 $\sigma$  bx= 288.3 N/mm<sup>2</sup>  $\sigma$  by= 33.8 N/mm<sup>2</sup>

#### 13. Examination of main frame connecting part

#### 13-1 Calculation of Load

· Anti-Power of rafter



P1=

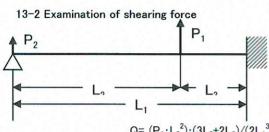
312.1 N

←from "Calculation of rafter"

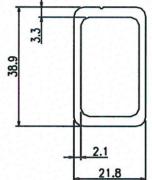
· Anti-Power of connecting rafter

P2=

←(Anti-Power of rafter)/2



L <sub>1</sub> (m)	1.22
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.51
A(mm²)	276.8
fs(N/mm <sup>2</sup> )	76.2



$$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_1$$

225.3 N 0.81 N/mm<sup>2</sup>

156.0 N

 $\tau = Q/A =$ 

0.02 < 1.0τ /fs=

OK!

## 14. Examination of front frame connecting part

#### 14-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

P1=

109.0 N

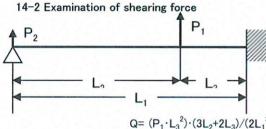
←from "Calculation of rafter"

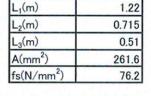


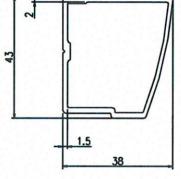
P2=

54.5 N

←(Anti-Power of rafter)/2







Q= 
$$(P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_3$$

78.7 N

 $\tau = Q/A =$ 

0.30 N/mm<sup>2</sup>

τ /fs=

0.01 < 1.0 OK!

## 15. Examination of gutter connecting part

#### 15-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

P1=

109.0 N

←from "Calculation of rafter"

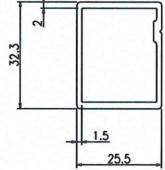
· Anti-Power of connecting rafter

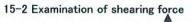
P2=

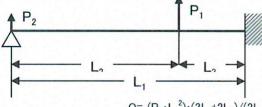
P2=

54.5 N

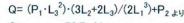
←(Anti-Power of rafter)/2







L <sub>1</sub> (m)	1.22
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.51
A(mm <sup>2</sup> )	192.1
fs(N/mm <sup>2</sup> )	76.2



Q=

78.7 N

 $\tau = Q/A =$ T /fs= 0.41 N/mm<sup>2</sup> 0.01 < 1.0

OK!

### 16. Examination of main frame and beam connection

### 16-1 Examination of screw pull-out force

·Pull-out force/screw

T= 554.0 N

·Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $172.7 \text{ N/mm}^2$ 

· Effective section

11.2 mm<sup>2</sup> A= 49.4 N/mm<sup>2</sup> σt=

0.29 < 1.0 OK!  $\sigma t/ft=$ 

β	0.6
Screw diameter	5
Core diameter	3.78
Pitch	0.8
t(Thickness)	4.6
Ft(Standard strength)	100

### 16-2 Examination of Beam bending stress

\*Beam top face bending moment

M= 3108.1 N·mm 58.6 mm<sup>3</sup> Z=

53.1 N/mm<sup>2</sup> σb=

0.26 < 1.0OK!  $\sigma$  b/fb=

b(Beam depth dimension)	61
t(Thickness)	2.4
a (load point)	18.5

### 17. Examination of rafter and main frame connection

### 17-1 Examination of screw pull-out force

·Pull-out force/screw

312.1 N

·Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $93.7 \text{ N/mm}^2$ 

93.7 N/mm<sup>2</sup>

• Effective section

A= 6.7 mm<sup>2</sup> 46.3 N/mm<sup>2</sup> σt=

 $\sigma t/ft=$ 0.49 < 1.0OK!

β	0.6
Screw diameter	4
Core diameter	2.93
Pitch	0.7
t(Thickness)	2.1
Ft(Standard strength)	100

### 17-2 Examination of Main frame bending stress

•Main frame top face bending moment

898.7 N·mm M= Z= 22.0 mm<sup>3</sup> 40.8 N/mm<sup>2</sup> σb=

0.20 < 1.0 OK!  $\sigma b/fb=$ 

b (Beam depth dimension)	25
t (Thickness) center	2.3
a(load point)	10

### 18. Examination of Roof material

### 18-1 Examination of Bending volume

Poisson ratio :  $\nu =$ 0.3 Bending volume: Wmax A · Wmax 3+B · Wmax+C=0 Distribution Load : P= 0.0116 kgf/cm<sup>2</sup> E: Young's modulus factor = 21000 kgf/cm<sup>2</sup> 0.18 cm A=  $(4 \nu /a^2b^2+(3-\nu^2)\cdot(1/a^4+1/b^4))/h^3$ Thickness:h= Short edge a= 70.3 cm 2096.9  $B = (4/3) \cdot (1/a^2 + 1/b^2)^2/h$ Long edge b= 296.2 cm 33.8  $C = -256(1 - \nu^2)P/(\pi^6Eh^4)$ -12701.0

Bending volume : Wmax=

1.82 cm

### 18-2 Bending stress degree

$$\max \sigma x = ((\pi^2 \cdot E \cdot W_{max})/(8 \cdot (1 - \nu^2))) \cdot ((2 - \nu^2) W_{max} + 4h)/a^{2+} (\nu (W_{max} + 4h))/b2)$$

$$= 44.4 \text{ kgf/cm}^2 < 551 \text{ kgf/cm}^2 \cdot \cdot \cdot \text{OK }!$$

### 18-3 Necessary depth of insert

Necessary depth of insert AL

$$\Delta L = \Delta X \times SF + \Delta I$$

However,  $\Delta X$ : The gap volume by a bend

$$= (lx - b)/2$$

Ix: Arc length while bending

 $= 2 \times \sin(-1(b/2)/r) \times r$ 

r: Radius rate while bending

$$= (b2+4\delta 2)/8\delta$$

 $\delta$ : Bending rate of Polycarbonate = Wmax (cm)

b: Length of short (cm)

 $\Delta I$ : The volume of expansion and contraction at temperature

$$= K \cdot \Delta t \cdot b/2$$

K : Line coefficient of expansion (cm/cm/°C)

∆t : Temperature differency at 50°C

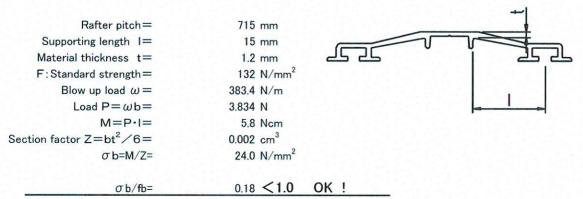
SF: Safety ratio SF=3. 0

r= 340.4 Ix= 70.43 cm  $\Delta$ X= 0.06 cm K= 0.00007 cm/cm/°C  $\Delta$ t = 50 °C SF= 3.0  $\Delta$ I= 0.12 cm

Therefore...

 $\Delta$  L= 0.31 cm depth or more < 1.89 cm  $\therefore$  OK!

### 19. Examination of Roof retainer



# 20. Ground Foundation

20–1 Without concrete floor Resistance moment  $M_R=(N+W)\times e+q\ \dot{s}\times b\times h_1\times (h_1+h_0)$ 

Σœ

h/2

-- h

MR-(N-W) × 6+q S × D × N<sub>1</sub> × (N<sub>1</sub>)
Resistance moment
M=M'+Q\*(h/2)−N × (d/2-a)

Base Foundation

Lateral Pressure 0.5

b= 0.90 m

d= 1.35 m

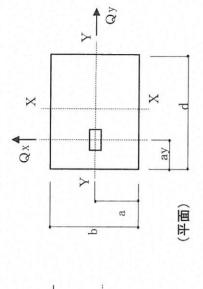
h= 0.55 m

ay= 0.30 m

ax=
Endurance strength of ground Fe=
Short Term Permissible Endurance strength of ground a=
No line concrete Volume weight

x = 0.45 m  $y = 100 \text{ KN/m}^2$   $q = 200 \text{ KN/m}^2$  $ght = 22.5 \text{ KN/m}^3$ 

1		- 0.0	(国頃人)	
		n <sup>z</sup>	n <sup>z</sup>	m³
Ε	Ε	KN/n	0 KN/n	KN/n
).30 m	3.45	100	200	22.5



...h0

×

h1

	Spindle Force(N)	Shear power(N)	wer(N)	Momen	ment(Nm)		Foundation size(m)	size(m)		Base Weight	Endurance strength of ground	Lateral Pressure
	z	Q×	Qy	×,×	M'y	q	P	4	a	(N)M	g'(kN/m2)	's(kN/m2)=0.5r
Long period load	611.6	0.0	0.0	9.669	0.0	06.0	1.35	0.55	0.30	15.036	100	
Short period load	5779.4	0.0	0.0	7695.5	0.0	06:0	1.35	0.55	0.30	15,036	200	
Short term earthquake X	611.6	155.0	0.0	9.669	348.8	06.0	1.35	0.55	0.30	15,036	200	100.0
Short term earthquake Y	611.6	0.0	155.0	1048.4	0.0	06.0	1.35	0.55	0.30	15.036	200	
Short period blow down + Holizontal	4269.0	637.4	0.0	5650.8	1434.2	06.0	1.35	0.55	0.30	15,036	200	
Short period blow down + Holizontal	4269.0	0.0	1119.4	8169.4	0.0	06'0	1.35	0.55	0.30	15,036	200	
Short period blow up+Holizontal X	-5484.1	637.4	0.0	-7552.5	1434.2	06.0	1.35	0.55	0.30	15,036	200	100.0
Short period blow up+Holizontal Y	-2484.1	0.0	-1119.4	-10071.1	0.0	06:0	1.35	0.55	0.30	15.036	200	,

■ Examination	l of	xamination of subsidence (short period snow)	iod snow)
subsidence load		Endurance strength of ground	
(N) M+N	\	$p \times d \times q$ (N)	
20815	/	243000OK	_

	per		_	_
243000	Examination of uplift (short period blow up)	Base weight	bxdxhx y(N)	15036
7	of		1	7
20815	■ Examination	uplift load	(N) N	5484

				X direction	ion				
	t(m)	e(m)	h0(m)	h1(m)	Resistance MRx	Fall Mx		Jube	UDGMENT
	$(N+W)/(b \times d)$	(d-t)/2	Qy/(b × q's)	(h-h0)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MR	MR≧M
Long period load	0.174	0.588	0000	0.275			0.037	101	ğ
Short period load	0.116	0.617	0000	0.275			0.281	<10	ð
Short term earthquake X	0.087	0.632	0000	0.275		470.3	0.028	<10	Š
Short term earthquake Y	0.087	0.632	0.002	0.274			0.052	V10	Š
Short period blow down + Holizontal X		0.621	0.000	0.275			0 215	01.0	Š
Short period blow down + Holizontal Y	0.107	0.621	0.012	0.269	18,798		0.366	V V	Š
Short period blow up+Holizontal X	0.053	0.648	0000	0.275		-5495.9	0.423	V 10	Š
Short period blow up+Holizontal Y	0.053	0.648	0.012	0.269		'	0.640	V10	Š

				Y direction	no				
	t(m)	e(m)	h0(m)	h1(m)	Resistance MRx	Fall M×		JUDGMENT	FNT
	$(N+W)/(d \times d)$	(b-t)/2	Qx/(d×q's)	(h-h0)/2	MRv(N·m)	Mv(N·m)	Mv/Mrv	M V M M	2
Short term earthquake X	0.058	0.421	0.001	0.274		391.5	0003	01.	ž
Short period blow down + Holizontal X	0.071	0.414	0.002	0.273		1609.5		017	3
Short period blow up+Holizontal X	0.035	0.432	0.005	0.273	14,338	1609.5	0.112	V 10	S



Fall moment M=M' +Q\*(h/2)

+C*(n/z)	Base Foundation	uc
	Lateral Pressure	0.5
	=q	0.70 m
	⊒ <sub>P</sub>	0.45 m
	=4	0.55 m
	1-14	0.45 m
	<u>11</u>	0.40 m
0	Concrete floor thickness t=	0.10 m
Endura	Endurance strength of ground Fe=	50 K

Short Term Permissible Endurance strength of ground q=No line concrete Volume weight  $\gamma$ = Concrete standard strength Fc=

NO			Ч Ч	h1			•	ゔ	(入幣面)		
	0.5	0.70 m	0.45 m	0.55 m	0.45 m	0.40 m	0.10 m	50 KN/m <sup>2</sup>	100 KN/m <sup>2</sup>	22.5 KN/m <sup>3</sup>	15000 KN/m <sup>3</sup>

W

THE Q

	A Q A		(国本)
× × ×	D	X	р
	A V		1: 緣端距離
***   ***	ブラケット厚さ (50mm)		

	Spindle Force(N)	Shear power(N)	ver(N)	Moment(Nm)	(mN):		Foun	Foundation size(m)		Base Weight	Endurance strength of ground	Lateral Pressure
	z	Š	δý	×,×	M'y	q	Р	h nd p	nd part lengtoor thicknes	nes W(N)	q'(kN/m2)	q'(kN/m2)  s(kN/m2)=0.5c
Long period load	611.6	0.0	0.0	9.669	0.0	0.70	0.45	0.55	0.40 0.		98 20	
Short period load	5779.4	0.0	0.0	7695.5	0.0	0.70	0.45	0.55	0.40 0.	0.10 3,898	100	50.0
Short term earthquake X	611.6	155.0	0.0	9.669	348.8	0.70	0.45	0.55	0.40 0.		100	50.0
Short term earthquake Y	611.6	0.0	155.0	1048.4	0.0	0.70	0.45	0.55	0.40 0.	10 3,898	100	20.0
Short period blow down + Holizontal >	4269.0	637.4	0.0	5650.8	1434.2	0.70	0.45	0.55	0.40 0.		100	20.0
Short period blow down + Holizontal \	4269.0	0.0	1119.4	8169.4	0.0	0.70	0.45	0.55	0.40 0.	10 3,898	100	
Short period blow up+Holizontal X	-5484.1	637.4	0.0	-7552.5	1434.2	0.70	0.45	0.55	0.40 0.		100	
Short period blow up+Holizontal Y	-5484.1	0.0	-1119.4	-10071.1	0.0	0.70	0.45	0.55	0.40 0.	10 3,898	100	50.0

Subsidence load Endrance strength of ground N+W (N) $\begin{array}{c c} & b \times d \times q(N) \\ \hline 9677 & 31500 \\ \hline \end{array}$	Examination of the control of the	of subsidence (sh	(short period show)
X	subsidence load	Endurance strength of ground	
9677 31500 OK !	(N) M+N	×	
	1196	31500	oK!

 ■ Concrete floor panchingshere (short term wind blow up)

 share force
 permissible share force

 Q (N)
 1.5 × fs × t × 0.91 × 2(N)

 76652
 1.5 × fs × t × 0.91 × 2(N)

(qu wold blow up)			OK!
Soncrete floor bearing capacity (short term wind blow up)	bearing capacity	$f_c \times b \times 0.875t/2(N)$	306250
or		1	/
■Concrete flo	share force	(N) Ø	76652

				X direction				
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		Danr	JUDGMENT
	N+W(N)	$(N+W)/(b \times q^2)$	(d-t)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MR	MR≧M
Long period load	4509.7	0.129	0.161	2,496	174.9	0.070	<1.0	
Short period load	9677.5		0.156		1923.9	0.381	<1.0	š
Short term earthquake X	4509.7		0.193		174.9			OK
Short term earthquake Y	4509.7		0.193	4,413			<1.0	OK
Short period blow down + Holizontal >			0.167	4,905			<1.0	ð
Short period blow down + Holizontal Y	8167.1	0.117	0.167	4,905	2070.3	0.422	<1.0	OK
Short period blow up+Holizontal X	0.0	0.000	0.225	3,544	-1888.1	0.533	<1.0	OK
Short period blow up+Holizontal Y	0.0	0.000	0.225	3,544	-2545.8	0.718	<1.0	OK

				Y direction		The second second second		
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		Danr	JUDGMENT
	N+M(N)	$(N+W)/(b \times d)$	(d-t)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MR	MR≧M
Short term earthquake X	4509.7		0.300	3,631	91.1	0.025	<1.0	OK :
Short period blow down + Holizontal X	8167.1	0.181	0.259	7	374.5	0.085	<1.0	ð
Short period blow up+Holizontal X	0.0	0.000	0.350	2,278	374.5	0.164	<1.0	OK :

### STATIC REPORT

PJR-series

5733-H23

2

### 1. Material and Evaluation

### 1)Post

Materi A6063S-T6(SS)

Material performance

ı	Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
L	Waterial	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
L	DE8389	15.92	662.16	188.59	88.29	39.70	70000	3.44	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb + \sigma c/fc =$ 

0.58 < 1.0 OK!

Wind blow down

 $\sigma b/fb + \sigma c/fc =$ 

0.57 < 1.0 OK!

Wind blow up

 $\sigma b/fb + \sigma t/ft =$ 

0.64 < 1.0 OK!

2-lk/i=

118.5 < 140 OK!

### 2Beam

Materi A6063S-T6(SS)

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Waterial	(cm2)	Ix(cm4)	ly(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8394	10.83	267.79	73.78	43.16	22.02	70000	2.61	180

Material evaluation (without support and side panel Vex=38m/s)

Snow for short period

 $\sigma b/fb=$ 

0.64 < 1.0 OK!

Wind blow down

 $\sigma$ bx/fbx=

0.47 < 1.0 OK!

Wind blow up

 $\sigma$ bx/fbx=

0.63 < 1.0 OK!

### 3Main frame

Materi A6063S-T6(SS)

Material performance

		1
Λ	U	1
V	115	

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Waterial	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8578有	1.64	5.33	2.07	2.27	0.91	70000	1.13	180

Material evaluation

 $\sigma b/fb=$ 

0.40 < 1.0 OK!

### 4)Front frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8401	2.55	12.50	6.91	3.81	2.20	70000	1.65	132

Material evaluation

 $\sigma b/fb=$ 

0.19 < 1.0 OK!

### **5**Rear frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second sect	ion moment	Section	factor	Elasticity factor	Cross-section radius	F value
Waterial	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8404有	2.55	7.70	5.90	2.34	1.82	70000	1.52	132

Material evaluation

 $\sigma b/fb=$ 

0.26 < 1.0 OK!

### 6 Rafter

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
iviateriai	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8654+DE8666	1.88	0.36	3.75	0.53	1.48	70000	1.41	132

Material evaluation

 $\sigma b/fb=$ 

0.57 < 1.0 OK!

7Side frame

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8683+DE8412	1.65	0.40	2.00	0.32	0.93	70000	1.10	132

Material evaluation

 $\sigma b/fb=$ 

0.40 < 1.0OK!

**®**Corner bracket

Materi SPFH590

Material performance

	Metavial	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
-	GB8064	8.58	205.21	65.07	28.12	20.34	210000	2.75	420

Material evaluation (without support and side panel Vex=38m/s)

 $\sigma$  bx/fb=

0.58 < 1.0OK!

 $\sigma$  by/fb=

0.10 < 1.0OK!

### 9 Main frame connecting parts

Materi A6063S-T5

Material performance

Γ	Matarial	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
ı	Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
Γ	GB8086	2.77	5.59	1.85	2.87	1.69	70000	0.82	132

Material evaluation

T/fs=

0.01 < 1.0 OK!

### **®**Front frame connecting parts

Materi A6063S-T5

Material performance

Material	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	ly(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8084	2.62	6.94	4.75	2.95	2.26	70000	1.35	132

Material evaluation

T /fs=

0.01 < 1.0 OK!

### (1) Rear frame connecting parts

Materi A6063S-T5

Material performance

Metavial	Cross-section area	Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
Material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
GB8085	1.92	2.92	1.83	1.78	1.40	70000	0.98	132

Material evaluation

 $\tau$  /fs=

0.01 < 1.0 OK!

12 Roof material

Materi

polycarbonate

 $\max \sigma x =$ 

Material performance

Material	Thickness	Length(short part)	Length(long part)	Inserting	Poisson ratio	Elasticity factor	F value
	cm	cm	cm	cm	ν	kgf/cm2	kgf/cm2
GB4107	0.18	70.3	326.4	1.89	0.3	21000	551

Material evaluation

Bending volume : Wmax=

1.82 cm

44.50 kgf/cm<sup>2</sup>

 $551.0 \text{ kgf/cm}^2$ 

∴ok !

Necessary depth of insert  $\Delta L$ 

0.31 cm depth or more

1.89 cm

∴ok!

®Roof retainer

Materi A6063S-T5

Material performance

Material Cross-section area		Second section moment		Section factor		Elasticity factor	Cross-section radius	F value
material	(cm2)	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	E(N/mm2)	i cm	N/mm2
DE8411	0.79	0.03	1.84	0.08	0.72	70000	1.52	132

<

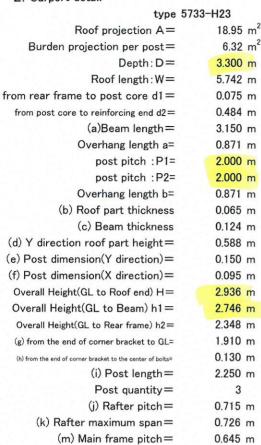
<

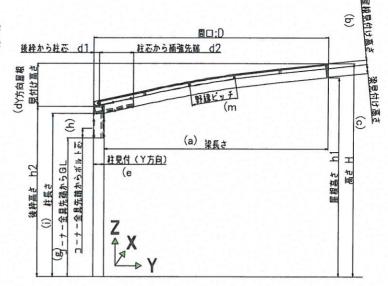
Material evaluation

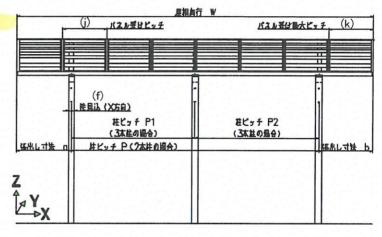
 $\sigma b/fb=$ 

0.18 < 1.0 OK!

### 2. Carport detail







### 3. Load design

①Vertical over load (G)

Part Weight

Roof	60.0 N/m <sup>2</sup>
Post	42.1 N/m

2 Snow over load

Post quantity	Snow area	Snow quantity	Unit weight	Short period snow period
2 posts type	General area	20 cm	30 N/m <sup>2</sup> /cm	600 N/m <sup>2</sup>

### 3 Wind blowing load(Vex=38m/s)

• For design of structure frame

Speed pressureq=0.  $6E(Vex*y)^2$ = 708 N/m<sup>2</sup> Standard wind speedVex= 38 m/s E=Er2Gf= 1.194 Er=1.  $7(Zb/Z_G)^{\alpha}$ = 0.691 Ground surface Div. III Gust influence factor Gf= 2.5 Zb= 5  $Z_G =$ 450 0.2

Installation period factor y= 0.827

· For roof material design

Average speed pressureq' = 0.  $6Er2(Vex\cdot y)^2$  = 283 N/m<sup>2</sup>

4 Earthquake power

Earthquake power Qi=Z·Rt·Ai·Co·Wi

Area factor Z=1.0Vibration feature Rt=1.0Coat shear power distribution factor Ai=1.0Standard shear power factor  $C_0=0.3$ 

### 4. Preparing calculation

### 4-1 Carport load (For earthquake power calculation)

Roof	379	N	
Post	95	N	
Wi=	474	N	

Earthquake power Qi=Z·Rt·Ai·Co·Wi=

142.1 N

### 4-2 Wind pressure power calculation (Maximum wind power pressure for 1 post)

### ·For design of structure frame

Wind factor

Independent shed

10°

0.60 (+pressure)

-1.00 (-pressure)

1.2 (Post flat power, side panel)

Wind pressureW=q C=

 $425 \text{ N/m}^2$ 

(Wind blow down)

 $-708 \text{ N/m}^2$ 

(Wind blow up)

849 N/m<sup>2</sup>

(Flat)

### ·Roof material design

Peak with factor calculation process Gpe=

3.1 (+pressure)

X

3.0 (-pressure: panel center part)

4.0 (-pressure: panel surrounding part)

Peak wind factor Cf=

0.60

1.86

3.0 -1.00X -1.004.0

-3.00-4.00

Wind pressure W=q' Cf=

527 N/m<sup>2</sup>

(Wind blow down)

=

 $-849 \text{ N/m}^2$ 

3.1

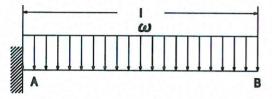
(Wind blow up)

 $-1132 \text{ N/m}^2$ 

(Wind blow up)

### 5. Beam material examination

### 5-1 Beam load(without support Vex=38m/s)



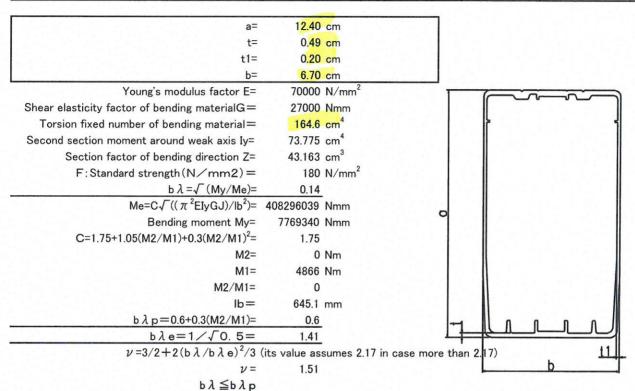
### Load chart

Туре			
Vertical load width (m)			2.000
I (m)	D-d1-	d2	2.741
Load	Long period	load	120.0
ω(N/m)	Short perio	d load	1320.0
	Short period blov	ving down(vertical)	969.3
	Short period blov	ving up(vertical)	-1295.5
	Short period blow	133.8	
	Short period eart	hquake(vertical)	120.0
	Short period eart	36.0	
	Long period	lload	450.8
	Short perio	4958.6	
Bending moment	Short period blow	3641.1	
M(N·m)	Short period blow	ving up(vertical)	-4866.5
	Short period blow	ving (horizontal)	502.5
	Short period eart	hquake(vertical)	450.8
	Short period eart	135.2	
Maximum bending mon	maxMx	(long period)	
(N·m)		(short period)	4958.6
	maxMy	(long period)	
		(short period)	502.5
Second section mome			267.8
	Iy(cm <sup>4</sup> )		73.8
Section factor	Zx(cm <sup>3</sup> )		43.2
	Zy(cm <sup>3</sup> )		22.0
Elasticity factor	E(N/cm <sup>2</sup> )		7000000
Maximum bending stre	maxσx		114.9
(N/mm2)	max σ y		22.8
Vertical maximum defo		(cm)	4.97
	max δ x∕I	1/	116
Flat maximum deforma	0.00	(cm)	1.83
	max δ y∕l	1/	314

### 5-2 Beam permissible stress degree Bending permissible stress degree



	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
bλ≦bλp	F/ ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5



119.5 N/mm<sup>2</sup> Permissible stress degree fb:  $F/\nu =$ 

Permissible stress degree at bend parts (strong axis)

### 1) Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

Гb = 0.65

a) Γb ≦ 1.34

fb = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fb = F - 0.248F \Gamma b$ 

c) 2.69 < \Gamma b

fb =  $2.41 \text{ F/}(\Gamma b^2)$ 

120.0 N/mm<sup>2</sup>

### 2) Web plate of beam (side face)

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

2.90

fb=

fbx=

a)  $\Gamma d \leq 3.29$ 

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

 $fb = 14.4 \, F/(\Gamma d^2)$ 

Therefore, result data is...

fbx= 120.0 N/mm<sup>2</sup>

7.76 WM.

120.0 N/mm<sup>2</sup>

180.0 N/mm<sup>2</sup>

### Permissible stress degree at bend parts (weak axis)

### 1) Frange plate of beam <top/bottom face>

$$\Gamma b := b/t \cdot \sqrt{(F/E)}$$

Γb = 2.90

a) Γb ≦ 1.34

fb = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fb = F - 0.248F \Gamma b$ 

c) 2.69 < \Gamma b

 $fb = 2.41 F/(\Gamma b^2)$ 

2) Web plate of beam (side face)

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

0.65

fb=

a) Γd ≤ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

 $fb = 14.4 \, F/(\Gamma d^2)$ 

Therefore, result data is...

51.7 N/mm<sup>2</sup> fby= 77.6 N/mm<sup>2</sup> fby=

OK!

120.0 N/mm<sup>2</sup>

51.7 N/mm<sup>2</sup>

### Section of the Beam examination

Snow for short period

M= 4958.6 N·m

 $\sigma b =$ 114.9 N/mm<sup>2</sup>

0.64 < 1.0  $\sigma b/fb=$ 

Wind blow down

M= 3641.1 N·m

 $\sigma bx =$ 84.4 N/mm<sup>2</sup>

 $\sigma bx/fbx=$ 0.47 < 1.0OK!

Wind blow up

M= -4866.5 N·m

σbx= 112.7 N/mm<sup>2</sup>

0.63 < 1.0OK!  $\sigma$  bx/fbx=

Wind blow horizontal

M= 502.5

σby= 22.8

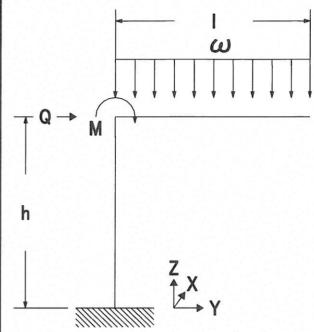
0.29 < 1.0 OK!  $\sigma$  by/fby=

### 6. Post material examination

### 6-1 Post load

### Load chart

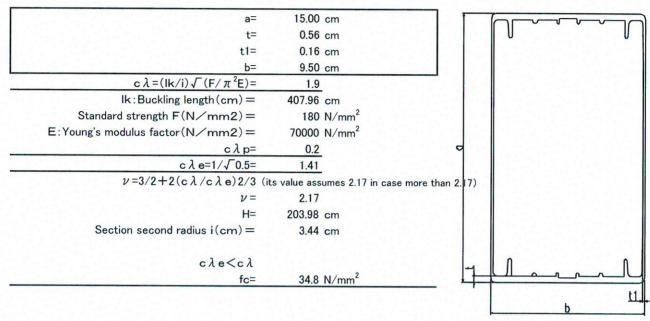
Type		
Type Vertical load width (m)		2.000
Vertical load width (m)	D-d1	3.150
1 (11)	Long period load	120.0
Load		1320.0
	Short period snow load	
ω(N/m)	Short period blowing down(vertical	
	Short period blowing up(vertical)	-1295.5
	Short period earthquake(vertical)	120.0
A : 1 C	Long period load	490.8
Axial force	Short period snow load	4450.8
by vertical load	Short period blowing down(vertical	
N(N)	Short period blowing up(vertical)	-4180.3
	Short period earthquake(vertical)	490.8
Flat load	Short period wind X	677.5
Q(N)	Short period wind Y	831.6
	Short period earthquakeX, Y	113.7
	Long period load	595.4
Bending moment	Short period snow load	6548.9
M(N·m)	Short period blowing down(vertical	
	Short period blowing up(vertical)	-6427.1
	Short period earthquake(vertical)	595.4
Bending moment	Short period blowing down(vertical)+WindY	6679.9
by vertical and flat load	Short period blowing up(vertical)+WindY	-8298.2
Mx(N·m)	Short period earthquake(vertical) + Earthquak	851.2
Bending moment	Short period windX	1524.5
by flat load	Short period earthquakeX	255.8
My(N·m)		
Maximum bending	maxMx (long period)	
moment(N·m)	(short period)	8298.2
	maxMy (short period wind)	1524.5
	(short period earthqual	255.8
Second section moment		662.155
	Iy(cm <sup>4</sup> )	188.59
Section factor	Zx(cm <sup>3</sup> )	88.287
	Zy(cm <sup>3</sup> )	39.70
Max. bending stress deg.	Long period load	6.74
$\sigma x(N/mm2)$	Short period snow load	74.18
February 2004	Short period blowing down(vertical	54.47
	Short period blowing up(vertical)	-72.80
	Short period earthquake(vertical)	6.74
	Short period blowing up(vertical)+WindY	75.66
	Short period blowing down(vertical)+WindY	-93.99
	Short period_earthquake(vertical) + Earthquak	9.64
	Officie portos carendadio(vorciosi) - Eurendadio	
$max \sigma x (N/mm2)$	Long period	6.74
$max \sigma x (N/mm2)$ (uniaxial bending)		6.74 93.99
	Long period	4004 2000



### 6-2 Post permissible stress degree

Permissible pressure stress degree

	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
c <i>λ</i> ≦cλρ	F/ ν	Long period x 1.5
<b>cλp<cλ≦cλe< b=""></cλ≦cλe<></b>	$(1.0-0.5((c\lambda-c\lambda p)/(c\lambda e-c\lambda p)))F/\nu$	Long period x 1.5
cλe <cλ< td=""><td><math>(1/c\lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></cλ<>	$(1/c\lambda^2) \cdot (F/\nu)$	Long period x 1.5



### Permissible stress degree at bend parts

### 1) Frange plate of beam <top/bottom face>

 $\Gamma b := b/t \cdot \sqrt{(F/E)}$ 

Γb = 0.83

a) Γb ≤ 1.34

$$fb = F/1.5$$

$$fb = F - 0.248F \Gamma b$$

fb = 
$$2.41 \text{ F/}(\Gamma b^2)$$

 $fb = 2.41 F/(1 b^2)$ 

fc= 120.0 N/mm<sup>2</sup>

### 2) Web plate of beam (side face)

 $\Gamma d := d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d = 4.40$ 

a) Γd ≦ 1.34

fb = F/1.5

b)  $1.34 < \Gamma d \le 2.69$ c)  $2.69 < \Gamma d$   $fb = F - 0.248F \Gamma d$ 

 $fb = 2.41 F/(\Gamma d^2)$ 

fc= 22.4 N/mm<sup>2</sup>

Therefore, result date is ...

fc= 22.4 N/mm<sup>2</sup> fc= 33.6 N/mm<sup>2</sup>



Permissible bending stress degree

	Permissible stress degree for long period (N/mm2)	For short period(N/m3)
bλ≦bλp	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5

					_
	15.00				
a=	15.00				
t=	0.56				
t1=	0.16	<mark>c</mark> m			
b=	9.50				
Young's modulus factor E=	70000	N/mm <sup>2</sup>			=
Shear elasticity factor of bending material G=	27000	Nmm	U		
Torsion fixed number of bending material=	340.2	cm <sup>4</sup>			
Second section moment around weak axis Iy=	188.588	cm <sup>4</sup>			
Section factor of bending direction Z=	88.287	cm <sup>3</sup>			
F: Standard strength (N/mm2) =	180	N/mm <sup>2</sup>			
b $\lambda = \sqrt{\text{(My/Me)}} =$	0.30				
$Me=C\sqrt{((\pi^2EIyGJ)/Ib^2)}=$	181147397	Nmm			
Bending moment My=	15891660				
$C=1.75+1.05(M2/M1)+0.3(M2/M1)^2=$	1				
M2=	-6427.1	Nm			
M1=	6427.1				
M2/M1=	-1	· ·			
W27   W1 =	1909.8	mm			
			L)	0 0 0	
$b \lambda p = 0.6 + 0.3 (M2/M1) =$	0.3		1		_
$b \lambda e = 1/\sqrt{0.5} =$	1.41		0.17)	b	
$\nu = 3/2 + 2(b \lambda / b \lambda e)^2/3$	(its value as	sumes 2.17 in case	e more than 2.17)		_

1.53

bλ≦bλp

117.7 N/mm<sup>2</sup> Permissble stress degree fb:  $F/\nu =$ 

Permissible bending stress degree (strong axis)

### 1) Frange plate <top/bottom face>

 $\Gamma$  b :The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

 $\Gamma_b =$ 0.83

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma b$ 

c)  $2.69 < \Gamma b$ 

 $fc = 2.41 F/(\Gamma b2)$ 

120.0 N/mm<sup>2</sup> fb=

### 2) Web plate <side face>

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

 $\Gamma d =$ 4.40

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F \Gamma d$ 

c) 6.57 < \Gamma\d

fb =  $14.4 \, \text{F}/(\Gamma \, \text{d}^2)$ 

100.0 N/mm<sup>2</sup> Therefore, result date is ... 100.0 N/mm<sup>2</sup> fbx= fbx= 150.0 N/mm<sup>2</sup>

### Permissible bending stress degree (weak axis)

### 1) Frange plate <top/bottom face>

 $\Gamma$ b :The conversion ratio = b/t  $\cdot \sqrt{(F/E)}$ 

a) Γb ≦ 1.34

$$fc = F/1.5$$

b) 
$$1.34 < \Gamma b \le 2.69$$

$$fc = F - 0.248F\Gamma d$$

c) 2.69 <  $\Gamma$ b

fc = 
$$2.41 \text{ F/}(\Gamma d2)$$

fb=

### 2) Web plate <side face>

 $\Gamma d$ : The conversion ratio =  $d/t \cdot \sqrt{(F/E)}$ 

a) Γd ≦ 3.29

$$fb = F/1.5$$

b)  $3.29 < \Gamma d \le 6.57$ 

$$fb = F - 0.101F\Gamma d$$

c) 6.57 < \Gamma\d

fb = 
$$14.4 \text{ F}/(\Gamma \text{ d}^2)$$

fb=

Therefore, result date is • • •

	fby=	22.4 N/mm <sup>2</sup>	
Ī	fbv=	33.6 N/mm <sup>2</sup>	

120.0 N/mm<sup>2</sup>

22.4 N/mm<sup>2</sup>

### Examination of the section of the post

Short period snow load

$$\sigma b = 74.2 \text{ N/mm}^2$$

$$\sigma c = \text{N/A} = 2.8 \text{ N/mm}^2$$

 $\sigma$ b/fb+ $\sigma$ c/fc= 0.58 <1.0 OK!

Wind blow down

$$\sigma$$
 b= 75.7 N/mm<sup>2</sup>  
 $\sigma$  c=N/A= 2.1 N/mm<sup>2</sup>

 $\sigma$ b/fb+ $\sigma$ c/fc= 0.57 <1.0 OK!

Wind blow up

$$\sigma b = 94.0 \text{ N/mm}^2$$

$$\sigma t = \text{N/A} = 2.6 \text{ N/mm}^2$$

 $\sigma_{b/fb} + \sigma_{t/ft} = 0.64 < 1.0$  OK!

2·lk/i= 118.5 < 140 OK!

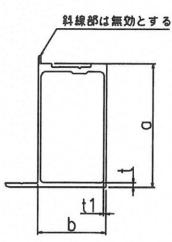
### 7. Main Frame Bending permissible stress degree

7-1 Bending permissible stress degree

00	-
But	V
	2

	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
bλ≦bλp	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td>(1/b λ<sup>2</sup>)·(F/ν)</td><td>Long period x 1.5</td></bλ<>	(1/b λ <sup>2</sup> )·(F/ν)	Long period x 1.5

a=	4.60	cm
t=	0.10	cm
t1=	0.09	cm
b=	2.50	cm
Young's modulus factor E=	70000	N/mm <sup>2</sup>
Shear elasticity factor of bending materialG=	27000	Nmm
Torsion fixed number of bending material=	3.2	cm <sup>4</sup>
Second section moment around weak axis Iy=	2.072	cm <sup>4</sup>
Section factor of bending direction Z=	2.274	cm <sup>3</sup>
F: Standard strength(N/mm2) =	180	N/mm <sup>2</sup>
b $\lambda = \sqrt{(My/Me)}$	0.27	
Me=C√(( $\pi$ 2EIyGJ)/Ib2)=	5535840	Nmm
Bending moment My=	409320	Nmm
C=	1.13	
lb=	715	mm
$b \lambda p = 0.6 + 0.3 (M2/M1) =$	0.3	
b λ e=1/√0.5=	1.41	



 $\nu$  =3/2+2(b  $\lambda$  /b  $\lambda$  e)  $^2$ /3 (its value assumes 2.17 in case more than 2.17)

0.41

 $\nu = 1.52$ 

 $b\lambda \leq b\lambda p$ 

fb= 118.1 N/mm<sup>2</sup>

### Permissible stress degree at bend parts

### 1) Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Гь=

a) Γb ≤ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c)  $0.876 < \Gamma b$ 

 $fb = 0.256 F/(\Gamma b^2)$ 

fb= 120.0 N/mm<sup>2</sup>

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Γb = 1.18

a) Γb ≦ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

c) 2.69 <  $\Gamma b$ 

 $fc = 2.41 F/(\Gamma d2)$ 

fb=  $120.0 \text{ N/mm}^2$ 

### 2) Wave plate of beam <side face>

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

 $\Gamma d = 2.48$ 

fb=

a)  $\Gamma d \leq 3.29$ 

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

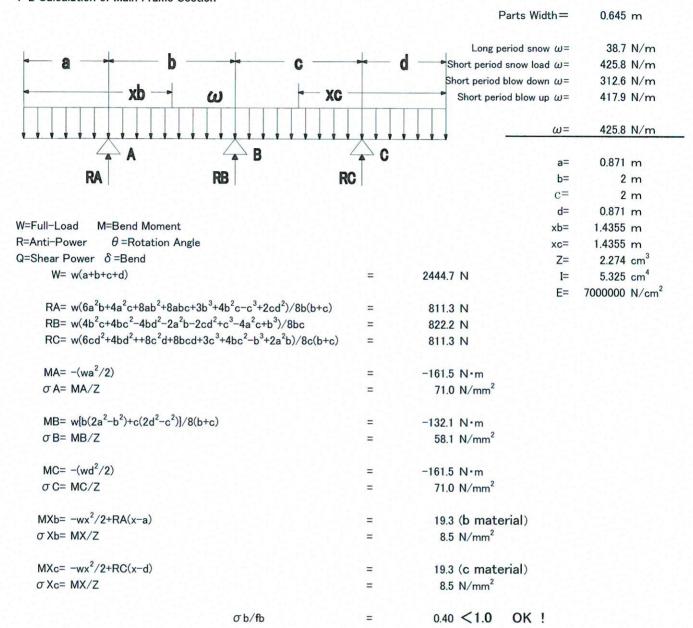
 $fb = 14.4 \, F/(\Gamma d^2)$ 

Therefore, result data is...

fb= 118.1 N/mm<sup>2</sup> fb= 177.1 N/mm<sup>2</sup>

120.0 N/mm<sup>2</sup>

### 7-2 Calculation of Main Frame Section



### 8. Front frame bending permissible stress degree

8-1 Bending permissible stress degree

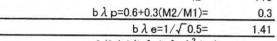
	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
ьλ≦ьλр	F/ <i>ν</i>	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td>(1/b λ<sup>2</sup>)·(F/ν)</td><td>Long period x 1.5</td></bλ<>	(1/b λ <sup>2</sup> )·(F/ν)	Long period x 1.5

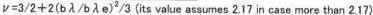
a= 4.77 cm t= 0.10 cm t1= 0.10 cm b= 4.20 cm

Young's modulus factor E= 70000 N/mm<sup>2</sup> Shear elasticity factor of bending materialG= 27000 Nmm Torsion fixed number of bending material= 8.4 cm4 6.911 cm4 Second section moment around weak axis Iy= Section factor of bending direction Z= 3.805 cm<sup>3</sup> F:Standard strength(N/mm2) = 132 N/mm<sup>2</sup>  $b \lambda = \sqrt{My/Me}$ 0.17 Me=C $\sqrt{((\pi 2EIyGJ)/Ib2)}$ = 16407392 Nmm 502260 Nmm

Bending moment My= 502260 Nmi
C= 1.13

| Ib= 715 mm





$$\nu = 1.51$$

ьλ≦ьλр

fb= 87.4 N/mm<sup>2</sup>

t1

### Permissible stress degree at bend parts

### 1) Frange plate of beam <top/bottom face>

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

a) Γb ≦ 1.34

$$fc = F/1.5$$

b)  $1.34 < \Gamma b \le 2.69$ 

$$fc = F - 0.248F \Gamma d$$

c)  $2.69 < \Gamma b$ 

$$fc = 2.41 \, F/(\Gamma d2)$$

 $1C = 2.41 \, \text{F/} \left( 1 \, \text{d2} \right)$ 

fb= 75.1 N/mm<sup>2</sup>

### 2) Web plate of beam <side face>

$$\Gamma d = d/t \cdot \sqrt{(F/E)}$$

$$\Gamma d = 1.98$$

a) Γd ≦ 3.29

$$fb = F/1.5$$

b)  $3.29 < \Gamma d \le 6.57$ 

fb = F 
$$- 0.101$$
F  $\Gamma$ 

c)  $6.57 < \Gamma d$ 

$$fb = 14.4 \, F/(\Gamma \, d^2)$$

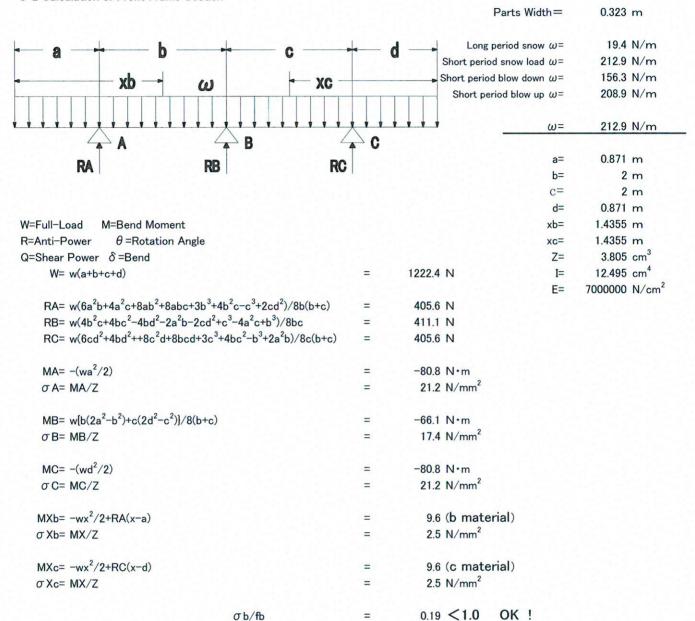
fb=

Therefore, result data is...

	fb=	112.7 N/mm <sup>2</sup>	
	fb=	75.1 N/mm <sup>2</sup>	
Therefore, result data is			

88.0 N/mm<sup>2</sup>

### 8-2 Calculation of Front Frame Section



### 9. Bending permissible stress degree at rear frame

### 9-1 Calculation method of effective section

 $\Gamma b = b/t \cdot \sqrt{(F/E)} = 0.438$  $b/t = 0.438/\sqrt{(F/E)} = 10.09$ 

Effective Depth

t2=

1.70 mm

Therefore...

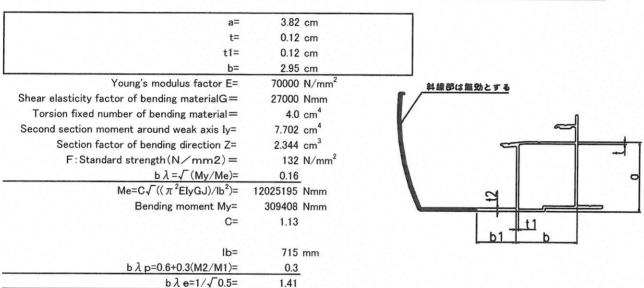
b1=

17.15 mm

### 9-2. Bending permissible stress degree at rear frame

Rending nermissible stress degree

Dending permissible stress degre	le .	
	Permissible stress degree for long period (N/mm2)	Permissible stress for short period(N/m3)
bλ≦bλp	F/ν	Long period x 1.5
bλp <bλ≦bλe< td=""><td><math>(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu</math></td><td>Long period x 1.5</td></bλ≦bλe<>	$(1.0-0.5((b\lambda-b\lambda p)/(b\lambda e-b\lambda p)))F/\nu$	Long period x 1.5
bλe <bλ< td=""><td><math>(1/b \lambda^2) \cdot (F/\nu)</math></td><td>Long period x 1.5</td></bλ<>	$(1/b \lambda^2) \cdot (F/\nu)$	Long period x 1.5



 $\nu = 3/2 + 2 \left( \frac{b \lambda}{b \lambda} \right)^2 / 3$  (its value assumes 2.17 in case more than 2.17)

 $\nu =$ 1.51

Ьλ≦Ьλр

87.5 N/mm<sup>2</sup> fb=

### Permissible stress degree at bend parts

### 1) Frange plate of beam (top/bottom face)

 $\Gamma b$ : The conversion ratio =  $b/t \cdot \sqrt{(F/E)}$ 

0.98

a) Γb ≤ 1.34

fc = F/1.5

b)  $1.34 < \Gamma b \le 2.69$ 

 $fc = F - 0.248F \Gamma d$ 

 $fc = 2.41 \, F/(\Gamma \, d2)$ 

c) 2.69 < \Gamma b

88.0 N/mm<sup>2</sup> fb=

### 2) Web plate of beam <side face>

 $\Gamma d = d/t \cdot \sqrt{(F/E)}$ 

Γd= 1.30

a) Γd ≦ 3.29

fb = F/1.5

b)  $3.29 < \Gamma d \le 6.57$ 

 $fb = F - 0.101F\Gamma$ 

c)  $6.57 < \Gamma d$ 

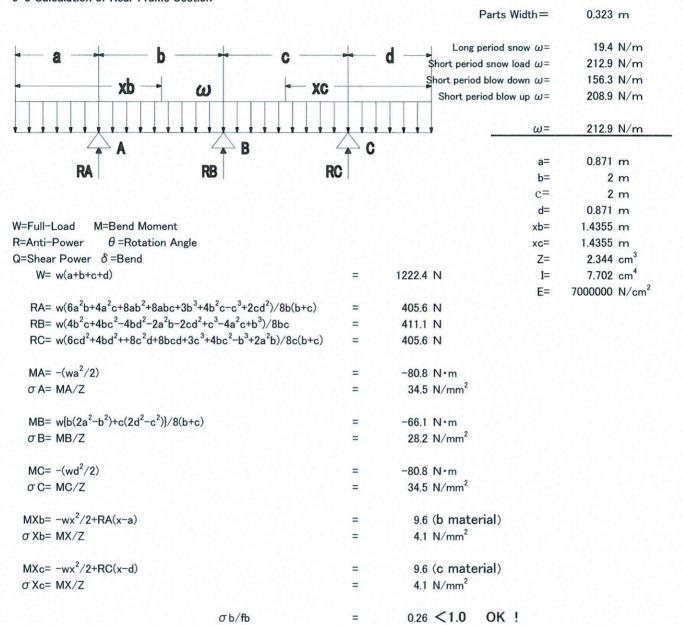
fb =  $14.4 \, \text{F}/(\Gamma \, \text{d}^2)$ 

88.0 N/mm<sup>2</sup> fb=

Therefore, result data is...

fb= 87.5 N/mm<sup>2</sup> fb= 131.2 N/mm<sup>2</sup>

9-3 Calculation of Rear Frame Section

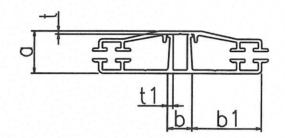


### 10. Rafter / Roof retainer bending permissible stress degree

10-1 Bending permissible stress degree

a=	1.30 cm
t=	0.10 cm
t1=	0.17 cm
b=	0.72 cm
b1=	1.99 cm

Young's modulus factor E=  $70000 \text{ N/mm}^2$ Shear elasticity factor of bending materialG= 27000 NmmSecond section moment around weak axis Iy=  $0.364 \text{ cm}^4$ Section factor of bending direction Z=  $0.529 \text{ cm}^3$ F: Standard strength (N/mm2) =  $132 \text{ N/mm}^2$ 



Therefore...

fb= 88.0 N/mm<sup>2</sup>

### Permissible stress degree at bend parts

### Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Γb = 0.86

a) Γb ≦ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

 $fb = F - 0.760F \Gamma b$ 

c)  $0.876 < \Gamma b$ 

 $fb = 0.256 F/(\Gamma b2)$ 

fb= 45.3 N/mm<sup>2</sup>

Therefore...

fb= 45.3 N/mm<sup>2</sup>
fb= 68.0 N/mm<sup>2</sup>

10-2 Calculation of Rafter / Roof retainer section

 $\sigma$ b/fb

				Parts Width=	0.715 m
<del> </del>		-1-	<del></del>	<b> =</b>	0.645 m
				Long period ω=	42.9 N/m
			Short perio	d snow load ω=	471.9 N/m
	<del>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</del>	* * * .		d blow down $\omega$ =	346.5 N/m
A 1	B 2 C	3	D 2 E 1 F Short per	riod blow up ω=	-463.1 N/m
				ω=	471.9 N/m
				Z=	0.529 cm <sup>3</sup>
W=Full-Load R=Anti-Pow		gle		I=	0.364 cm <sup>4</sup>
Q=Shear Po	ower δ=Bend			E=	7000000 N/cm <sup>2</sup>
	ωΙ	=	304.4 N		
RA=	$0.395 * \omega 1$	=	120.2 N		
RB=	$1.131 * \omega I$	=	344.3 N		
RC=	$0.974 * \omega 1$	=	296.5 N		
RD=	$0.974 * \omega 1$	=	296.5 N		
RE=	$1.131 * \omega I$	=	344.3 N		
RF=	0.395 * ωI	=	120.2 N		
Rmax=			344.3 N		
MB=	$-0.105+*\omega1^{2}$	=	-20.6 N⋅m		
MC=	$-0.079 * \omega 1^{2}$	= ;	-15.5 N•m		
MD=	$-0.079 * \omega 1^{2}$	=	−15.5 N•m		
ME=	$-0.105+*\omega^{2}$	=	-20.6 N•m		
M1=	$0.078 * \omega 1^{2}$	=	15.3 N•m		
M2=	$0.033 * \omega 1^{2}$	=	6.5 N·m		
M3=	$0.046 * \omega 1^{2}$	=	9.0 N·m		
σ X=	MX/Z	=	39.0 N/mm²		

0.57 < 1.0 OK!

### 11. Side frame bending permissible stress degree

### 11-1 Calculation method of effective section

 $\Gamma b = b/t \cdot \sqrt{(F/E)} = 0.438$  $b/t = 0.438/\sqrt{(F/E)} = 10.09$  Therefore...

Effective Depth

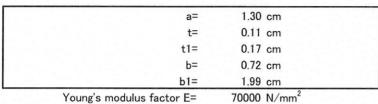
t2=

1.20 mm

b2=

12.10 mm

### 11-2 Bending permissible stress degree



Shear elasticity factor of bending materialG= 27000 Nmm Second section moment around weak axis Iy= 2 cm<sup>4</sup> 0.324 cm<sup>3</sup> Section factor of bending direction Z=

F: Standard strength (N/mm2) =

132 N/mm<sup>2</sup>

Therefore...

88.0 N/mm<sup>2</sup> fb=

### Permissible stress degree at bend parts

Frange plate of beam <top/bottom face>

 $\Gamma$ b : The conversion ratio = b/t •  $\sqrt{(F/E)}$ 

Гь = 0.79

a) Γb ≦ 0.438

fb = F/1.5

b)  $0.438 < \Gamma b \le 0.876$ 

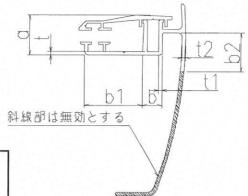
fb = F -  $0.760F \Gamma b$ 

c) 0.876 < Гb

 $fb = 0.256 F/(\Gamma b2)$ 

53.2 N/mm<sup>2</sup> fb= Therefore···

53.2 N/mm<sup>2</sup> fb= fb= 79.8 N/mm<sup>2</sup>



11-3 Calculation of Side frame secton

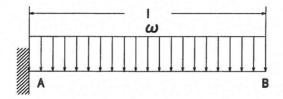
 $\sigma$ b/fb

						Parts Width=	0.363	m
- 1 -	<del> </del>   <del> </del>	1 -	1 -	— I –	-	I=	0.645	m
						Long period ω=	21.8	N/m
					Short peri	od snow load ω=	239.6	N/m
						od blow down ω=	175.9	N/m
A 1	B 2 C	3 D	2 E	1	F Short pe	eriod blow up $\omega$ =	-235.1	N/m
						ω=	239.6	N/m
						Z=	0.324	cm <sup>3</sup>
						I=	0.399	cm <sup>4</sup>
W=Full-Load	M=Bend Moment							0
R=Anti-Power						E=	7000000	N/cm <sup>2</sup>
Q=Shear Powe								
	ωΙ		154.6	V				
RA=	0.395 * ωΙ	_	61.0 1	N				
RB=	1.131 * ωΙ	=	174.8 1	V				
RC=	0.974 * wl	=	150.5 1	V				
RD=	$0.974 * \omega 1$	= 10 10 10 10 10	150.5	V				
RE=	$1.131 * \omega I$	=	174.8 1	V				
RF=	0.395 * ωI	=	61.0 1	V				
Rmax=			174.8 1	V				
MB=	$-0.105+*\omega1^{2}$	=	-10.5 1					
MC=	$-0.079 * \omega 1^{2}$	<b>=</b>	-7.9					
MD=	$-0.079 * \omega 1^{2}$	=	-7.9					
ME=	$-0.105+*\omega ^{2}$	= -	-10.5 1					
M1=	$0.078 * \omega 1^{2}$	<b>.</b>	7.8 1					
M2=	0.033 * ωl <sup>2</sup>	J= 111111111111111111111111111111111111	3.3 1					
M3=	0.046 * ωΙ <sup>2</sup>	=	4.6 1	V•m				
σ X=	MX/Z	=	32.3 1	N/mm²				

0.40 < 1.0 OK!

### 12. Corner bracket examination

### 12-1 Beam load



### Load chart

Туре			
Vertical load width (m)			2.000
I (m)	D-c	3.225	
Load	Long period	load	120.0
ω(N/m)	Short period	d snow load	1320.0
	Short period blow	ing up(vertical)	969.3
	Short period blow	ing up(vertical)	-1175.5
	Short period blow	ing down(horizontal)	160.5
	Short period earth	nquake(vertical)	120.0
	Short period earth	nquake(horizontal)	36.0
	Long period	load	624.0
	Short period	d snow load	6864.4
Bending moment	Short period blow	ing up(vertical)	5040.6
M(N·m)	Short period blow	ing up(vertical)	-6112.8
	Short period blowing down(horizontal)		834.7
	Short period earthquake(vertical)		624.0
	Short period earth	nquake(horizontal)	187.2
Maximum bending momen	maxMx	(long period)	
(N·m)		(short period)	6864.4
	maxMy	(long period)	
		(short period)	834.7
Second section moment	Ix(cm <sup>4</sup> )		267.8
	Iy(cm <sup>4</sup> )		73.8
Section factor	Zx(cm <sup>3</sup> )		43.2
	Zy(cm <sup>3</sup> )		22.0
Elasticity factor	E(N/cm²)		21000000
Maximum bending stress degree	max σ x		159.0
(N/mm2)	max σ y		37.9
Vertical maximum deformation quantity	max δ x	(cm)	3.17
	max δ x / I	1/	181
Flat maximum deformation quantity	max δ y	(cm)	1.40
	$\max \delta y/I$	1/	410

### 12-2 Calculation of Corner bracket Section

Material	Second sec	tion moment	Section factor		
Iviaterial	Ix(cm4)	Iy(cm4)	Zx(cm3)	Zy(cm3)	
GB8064	205.211	65.073	28.119	20.335	

fb= 420 N/mm²
Mx= 6864.4 N·m
My= 834.7 N·m

σbx= 244.1 N/mm²
σby= 41.0 N/mm²

σbx/fb= 0.58 <1.0 OK!
σby/fb= 0.10 <1.0 OK!

- 24 -

### 13. Examination of main frame connecting part

### 13-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

344.3 N

←from "Calculation of rafter"

· Anti-Power of connecting rafter

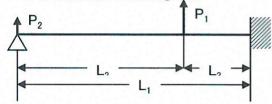
P2=

P2=

172.2 N

←(Anti-Power of rafter)/2

### 13-2 Examination of shearing force



L <sub>1</sub> (m)	0.87
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.16
A(mm <sup>2</sup> )	276.8
fs(N/mm²)	76.2

38

$$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + L_3$$

0.68 N/mm<sup>2</sup>

187.7 N

 $\tau = Q/A =$ 

T /fs=

0.01 < 1.0

OK!

### 14. Examination of front frame connecting part

### 14-1 Calculation of Load

· Anti-Power of rafter

P<sub>1</sub>=

P1=

120.2 N

←from "Calculation of rafter"

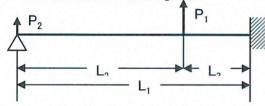
· Anti-Power of connecting rafter

P2=

60.1 N

←(Anti-Power of rafter)/2

### 14-2 Examination of shearing force



L <sub>1</sub> (m)	0.87
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.16
A(mm²)	261.6
fs(N/mm²)	76.2

$$Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + U_3$$

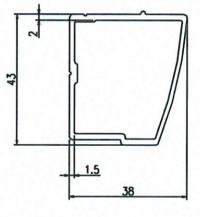
65.6 N Q=

 $\tau = Q/A =$ 

0.25 N/mm<sup>2</sup>

τ/fs=

0.01 < 1.0 OK!



2.1

21.8

### 15. Examination of gutter connecting part

### 15-1 Calculation of Load

· Anti-Power of rafter

P1=

120.2 N

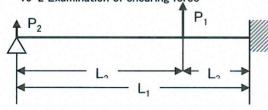
←from "Calculation of rafter"

·Anti-Power of connecting rafter

60.1 N

←(Anti-Power of rafter)/2

### 15-2 Examination of shearing force



L <sub>1</sub> (m)	0.87
L <sub>2</sub> (m)	0.715
L <sub>3</sub> (m)	0.16
A(mm <sup>2</sup> )	192.1
fs(N/mm²)	76.2

 $Q = (P_1 \cdot L_3^2) \cdot (3L_2 + 2L_3) / (2L_1^3) + P_2 + U_3$ 

Q=

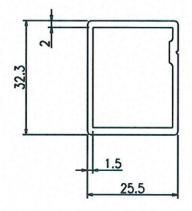
65.6 N

 $\tau = Q/A =$ 

0.34 N/mm<sup>2</sup>

T /fs=

0.01 < 1.0 OK!



### 16. Examination of main frame and beam connection

### 16-1 Examination of screw pull-out force

·Pull-out force/screw

Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $172.7 \text{ N/mm}^2$ 

•Effective section

	44.0	2	
A=		mm <sup>2</sup>	
σt=	36.6	$N/mm^2$	
			0.00

 $\sigma t/ft = 0.21 < 1.0 OK!$ 

### β 0.6 Screw diameter 5 Core diameter 3.78 Pitch 0.8 t(Thickness) 4.6 Ft(Standard strength) 100

61

2.4

18.5

### beam depth dimension) b(Beam depth dimension) t(Thickness)

a (load point)

### 16-2 Examination of Beam bending stress

·Beam top face bending moment

M=	2306.4	$N \cdot mm$
Z=	58.6	mm <sup>3</sup>
$\sigma$ b=	39.4	$N/mm^2$
/0 -	0.10	110

 $\sigma_{\rm b/fb}$ = 0.19 < 1.0 OK !

### 17. Examination of rafter and main frame connection

### 17-1 Examination of screw pull-out force

·Pull-out force/screw

Stretching permissible stress

ft= 
$$2.1 \cdot \beta \cdot ((d^2 - d_1^2)/(P \cdot d^4))^{0.5} \cdot t^{1.2} \cdot Ft \cdot 1.5$$
  
=  $104.5 \text{ N/mm}^2$ 

• Effective section

A=	6.7 mm <sup>2</sup>		
$\sigma$ t=	51.1 N/mm <sup>2</sup>		
$\sigma t/ft=$	0.49 < 1.0	OK	ļ

### 17-2 Examination of Main frame bending stress

• Main frame top face bending moment

M=	991.6	$N \cdot mm$		
Z=	22.0	mm <sup>3</sup>		
$\sigma$ b=	45.0	$N/mm^2$		
$\sigma$ b/fb=	0.22	<1.0	OK	!

β	0.6
Screw diameter	4
Core diameter	2.93
Pitch	0.7
t(Thickness)	2.3
Ft(Standard strength)	100

b (Beam depth dimension)	25
t(Thickness) center	2.3
a (load point)	10

### 18. Examination of Roof material

### 18-1 Examination of Bending volume

Poisson ratio : $\nu =$	0.3	Bending volume: Wmax
Distribution Load :P=	$0.0116 \text{ kgf/cm}^2$	A·Wmax³+B·Wmax+C=0
E: Young's modulus factor =	21000 kgf/cm <sup>2</sup>	
Thickness:h=	0.18 cm	$A = (4 \nu / a^2 b^2 + (3 - \nu^2) \cdot (1/a^4 + 1/b^4))/h^3$
Short edge a=	70.3 cm	= 2086.4
Long edge b=	326.4 cm	$B = (4/3) \cdot (1/a^2 + 1/b^2)^2 / h$
		= 33.2
		$C = -256(1 - \nu^2)P/(\pi^6Eh^4)$
		= -12701.0
	The second secon	

Bending volume : Wmax= 1.82 cm

### 18-2 Bending stress degree

### 18-3 Necessary depth of insert

Necessary depth of insert AL

 $\Delta L = \Delta X \times SF + \Delta I$ 

However,  $\Delta X$ : The gap volume by a bend

= (lx - b)/2

Ix: Arc length while bending

 $= 2 \times \sin(-1(b/2)/r) \times r$ 

r : Radius rate while bending

 $= (b2+4\delta 2)/8\delta$ 

 $\delta$ : Bending rate of Polycarbonate = Wmax (cm)

b: Length of short (cm)

 $\Delta\,\text{I}\,$  : The volume of expansion and contraction at temperature

 $= K \cdot \Delta t \cdot b/2$ 

K : Line coefficient of expansion (cm/cm/°C)

∆t : Temperature differency at 50°C

SF: Safety ratio SF=3. 0

r= 339.8 Ix= 70.43 cm  $\Delta$  X= 0.06 cm K= 0.00007 cm/cm/°C  $\Delta$  t = 50 °C SF= 3.0  $\Delta$  I= 0.12 cm

Therefore···

Δ L= 0.31 cm depth or more < 1.89 cm ∴ OK!

### 19. Examination of Roof retainer

The manufactors of the of the cannot			
Rafter pitch=	715 mm		
Supporting length I=	15 mm		+1
Material thickness t=	1.2 mm		
F: Standard strength=	132 N/mm <sup>2</sup>		
Blow up load $\omega =$	383.4 N/m	25 25	
Load $P = \omega b =$	3.834 N		
M=P·I=	5.8 Ncm		
Section factor Z=bt <sup>2</sup> /6=	$0.002 \text{ cm}^3$		
$\sigma$ b=M/Z=	24.0 N/mm <sup>2</sup>		
σb/fb=	0.18 < 1.0	OK!	

# 20. Ground Foundation

20–1 Without concrete floor Resistance moment  $M_R=(N+W)\times e+q^is\times b\times h_1\times (h_1+h_0)$ 

Σœ

h/2

- h-

Resistance moment  $M=M'+Q*(h/2)-N \times (d/2-a)$ 

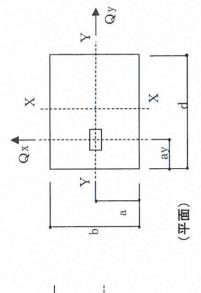
Base Foundation Lateral Pressure

0.90 m 1.10 m 0.55 m 0.30 m 및 # L

Endurance strength of ground Fe= Short Term Permissible Endurance strength of ground q= No line concrete Volume weigh

E	KN/m <sup>2</sup>	KN/m <sup>2</sup>	5 KN/m <sup>3</sup>
0.45 m	100 KN	200 KN/r	22.5
11	II	II	Ħ

(Y断面)



 $\geq$ 

h1

	Spindle Force(N)	Shear power(N)	wer(N)	Moment	nt(Nm)		Foundation size(m)	ize(m)		Base Weight	Endurance strength of ground	Lateral Pressure
	z	ð	જે	׸×	M'y	q	Р	h	В	W(N)	q'(kN/m2)	's(kN/m2)=0.5c
Long period load	490.8	0.0	0.0	595.4	0.0	06.0	1.10	0.55	0.30	12,251	100	20.0
Short period load	4450.8	0.0	0.0	6548.9	0.0	06.0	1.10	0.55	0.30	12,251	200	100.0
Short term earthquake X	490.8	113.7	0.0	595.4	255.8	06.0	1.10	0.55	0.30	12,251	200	100.0
Short term earthquake Y	490.8	0.0	113.7	851.2	0.0	06.0	1.10	0.55	0.30	12,251	200	100.0
Short period blow down + Holizontal	3293.4	677.5	0.0	4808.8	1524.5	06.0	1.10	0.55	0.30	12,251	200	
Short period blow down + Holizontal	3293.4	0.0	831.6	6679.9	0.0	06.0	1.10	0.55	0.30	12,251	200	100.0
Short period blow up+Holizontal X	-4180.3	677.5	0.0	-6427.1	1524.5	06.0	1.10	0.55	0.30	12,251	200	_
Short period blow up+Holizontal Y	-4180.3	0.0	-831.6	-8298.2	0.0	06'0	1.10	0.55	0.30	12,251	200	100.0

xamination of subsidence (short period snow)	idence load Endurance strength of ground	$(N) \bowtie p \times p \times q \qquad (N) M+$	16702 198000 :: OK!
■ Exam	subsidence	M+N	

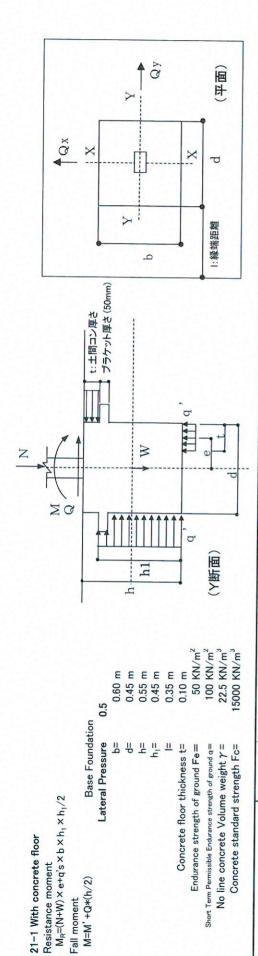
Base weight	N)
	pe
of up	examination of uplift (short period blo
	o d

xamination	0	:xamination of upilit (short period blow up)	Short period blow down + Hollzontal A	5
olift load		Base weight	Short period blow down + Holizontal Y	0
(N) N	1	$p \times d \times h \times \gamma(N)$	Short period blow up+Holizontal X	0
4180	/	12251 OK!	Short period blow up+Holizontal Y	0

								=:							-
1	MR≧M	S	Š	ok	ŏ	Š	o K	OK OK	ÖK		JUDGMENT	MR≧M	OK	Š	OK
,	MR	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		JUDC	ME	<1.0	<1.0	V1.0
	Mx/MRx	0.050 <1.0	0.357 <	0.035	0.057	0.271 <1.0	0.414 < 1.0	0.486 < 1.0	0.676			My/Mry	0.024	0.129	0 166
	Mx(N·m)	472.7	5436.2	472.7	759.7	3985.5	6085.3	-5382.1	-7481.8		Fall Mx	My(N·m)	287.1	1710.8	1710.8
	MRx(N·m)	9,509	15,217	13,363	13,363	14,685	14,683	11,064	11,062	on	Resistance MRx	MRy(N·m)	12,171	13,251	10.289
	(h-h0)/2	0.275	0.275	0.275	0.274	0.275	0.270	0.275	0.270	Y direction	h1 (m)	(h-h0)/2	0.274	0.272	0 272
	Qy/(b×q's)	0.000	0000	0.000	0.001	0.000	0000	0.000	0.009		h0(m)	Qx/(d x q's)	0.001	900'0	9000
11110	(d-t)/2	0.479	0.504	0.515	0.515	0.507	0.507	0.528	0.528		e(m)	(b-t)/2	0.421	0.415	0 432
	$(N+W)/(b \times d)$	0.142	0.093	0.071	0.071	980.0	980.0	0.045	0.045		t(m)	$(N+W)/(d \times d)$	0.058	0.071	0 037
		Long period load	Short period load	Short term earthquake X	Short term earthquake Y	Short period blow down + Holizontal X	Short period blow down + Holizontal Y	Short period blow up+Holizontal X	Short period blow up+Holizontal Y				Short term earthquake X	Short period blow down + Holizontal X	Short period blow un+Holizontal X

X direction

X direction



	Spindle Force(N)	Shear power(N)	wer(N)	Moment(Nm)	E(Nm)		Foun	Foundation size(m)			Base Weight	Endurance strength of ground	Lateral Pressure
	z	ğ	ð	×. Z	, Z	Ч	7	d bu	and read the participation of		A/(NI)	_	10 (0 / 11)
Look poison and	4000	0	00	. 107		-1			Lierigion till		(N) (N)	d (KIN/ mz)	S(KN/mZ)=0.5c
Long period load	490.8	0.0	0.0	595.4	0.0	09.0	0.45	0.55	0.35	0.10	2 241	L L	020
Short period load	4450.8	0.0	0.0	6248.9	00	080	0.45	0.55	36.0		1,00	000	0.02
V claimatras much trado	0000	1077	00			0000	2.0	0.00	0.00	0.10	145,5	200	20.0
Olloir term earthquake A	490.8	113.7	0.0	595.4	255.8	0.60	0.45	0.55	0.35	0.10	2 2/11	100	000
Short term earthquake Y	4908	00	1107	0 1 0	00	000		000	0000	2	-+0,0	001	0.00
מים הולממים	0.00	0.0	1.0.1	7.108	0.0	0.60	0.45	0.55	0.35	0.10	3 341	100	50.0
Short period blow down + Holizontal >	3293.4	677.5	0.0	4808.8	1524.5	090	0.45	0.55	0.25	010	0,00	200	0.00
Short period blow down + Holizontal N	32934	00	8316	66700	0	0000	2 4	0.00	0.00	2 !	140,0	201	0.00
777	00077	2 1	0.100	0.010.0	0.0	0.00	0.45	0.55	0.35	0.10	3,341	100	20.0
Strort period blow up+Holizontal A	-418U.3	01/10	0.0	-6427.1	1524.5	09.0	0.45	0.55	0.35	010	2 3 4 1	100	000
Short period blow up+Holizontal Y	-41803	00	-8316	0000	0	000	14.0		0 10	2	0,0	20	0.00
	2000	2.0	0.00	7.0670	0.0	0.00	0.45	0.55	0.35	0.10	3.341	100	50.0
										-			0.00

usidelice load		Endurance strength of ground
(N) M+N	1	(N) b x p x q
7792	/	27000 OK!

94500 OK	94500	/	63068
	$1.5 \times f_S \times t \times 0.91 \times 2(N)$	\	(N)
	permissible share force		share force
vind blov	Concrete floor panchingshere (short term wind blow	00	■ Concrete 1

: OK :	wind blow up)			. OK
94500]OK	Concrete floor bearing capacity (short term wind blow up)	bearing capacity	$f_c \times b \times 0.875t/2(N)$	262500OK
	or		1	/
93008	■Concrete flo	share force	(N) Ø	63068

	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		JUDGMENT	L
	N+W(N)	$(N+W)/(b \times q')$	(d-t)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MRNM	Σ
Long period load	3832.0	0.128	0.161	2,136	148.8	0.070 < 1.0		- X
Short period load	7792.0	0.130	0.160	4,285	1637.2	0.382	<1.0	- XO
Short term earthquake X	3832.0	0.064	0.193	3,777	148.8	0.039	<1.0	OK -
Short term earthquake Y	3832.0	0.064	0.193	3,777	215.6	0.057	<1.0	- XO
Short period blow down + Holizontal >	6634.7	0.111	0.170	4,163	1202.2	0.289	<1.0	OK -
Short period blow down + Holizontal Y	6634.7	0.111	0.170	4,163	1690.8	0.406	<1.0	- XO
Short period blow up+Holizontal X	0.0	0.000	0.225	3,038	-1606.8	0.529 < 1.0		- XO
Short period blow up+Holizontal Y	0.0	0.000	0.225	3,038	-2095.3	0.690 <1.0		- XO
				Y direction				
	Vertical load	t(m)	e(m)	Resistance MRx	Fall Mx		JUDGMENT	Z
	N+W(N)	$(N+W)/(b \times q')$	(d-t)/2	MRx(N·m)	Mx(N·m)	Mx/MRx	MRNM	5
Short term earthquake X	3832.0	0.085	0.257	4,024	8.99	0.017 < 1.0		OK -
Short period blow down + Holizontal X	6634.7	0.147	0.226	4,539	398.1	0.088 < 1.0		OK -
Short period blow up+Holizontal X	0.0	0.000	0.300	3,038	398.1	0.131 < 1.0		OK -

5730 - POST

### AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Member	beam
Tonly	

	Product		Tension		Compressio	r	Shea	•		Bea	ring		Modu	lus of E
Alloy and tamper	Froduct	Ftu	Fty		Fcy	Fsu	Fs	y	Fbu		Fbv		E	0.000
6063 T6	Extrusions		207	172	172		131	96		434	HAN	276		70000
					180	)								

Table 3.3(D) Page 20

Type of member		Intercept	115 4	Slope	Intersection			
stress					intersection			
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591		
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145		
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error		
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674		
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952		
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859		
Ultimate strength of flat plates in compression								
Ultimate strength of flat plates in bending	k1	0.35		2.27				

Table 3.4 (A) Page	21

Factor of safety	Normal buildings
φγ	0.95
φu	0.85
φνρ	0.9
φb	0.85
фср	0.8
φw	0.9
φς	0.85
φν	0.8
φcc s	ee below

Table 3.4 (b) Page 21

**RHS/SHS** section properties

Effective Length (m)

2750 mm between restraints

Height

150 mm

Width

95 mm

Walls side (avg if

complex shape)

1.6 mm

Walls top/bottom (average is complex

shape)

lx

5.6 mm 6621600

CM (CANTAPORT) 662.16

ly	1885900	188.59
J (Torsion constant		
(warp))	3402000	340.2
Zx	88290	88.29
Zy	39700	39.7
Area	. 1592	15.92
Radius of gyration		
Rx	64.49260797 mm	
Radius of gyration		
Ry	34.41817184 mm	

### **Bending** capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 191.7113041

Zc 88290 Assumed to be Zx

**S1** 1.792654179 52 2417.766287 mpa

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<5 142.9393882 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 1196.855281 mPa

### MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 26.5842941 Note Clause Ry=Rye Page 37 Bottom Para

26.5842941 Rye 103.444537

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1 = 1

ky 103.4445372 rye **S1** -2.570688695 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 142.9393863 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 1196.855042 mPa

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 86.75 138.8 S1 38.36639146 S2 90.53212769

Equ-3.4.22(1): N<S1 190.06
Fqu-3.4.22(2): S1<N<S 140.396174

Equ-3.4.22(2): S1<N<! 140.396174 Add tripple to one formula

Equ-3.4.22(3): S2>N 140.5560979

FLANGE

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 16.39285714

H 91.8 Add tripple to one formula

\$1 12.41378457 \$2 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<: 156.9032732 mPa Equ-3.4.17(3): S2>N 257.1171799 mPa

## Compression capacity

## 3.4.8.1-Genreal compression

k 1
Dc 62.79993051
S1 0.581870399
S2 1.241183988
λx 0.672716031
λy 1.260532124

X-X y-y

(see limits λ<1.2 0.858739633 0.73528825

 φcc limits λ<1.2</td>
 0.858729633
 0.73528825

 φcc limits λ>1.2
 0.674180244
 0.7564745

X-X Y-Y

Equ-3.4.8.1 (1) N<s1 131.8763366 112.919268 mPa

103.5348232 116.172869 mPa

Equ-3.4.8.1 (2) s1<n<: 126.9771987 81.581349 mPa and choise 99.68855795 83.9319949 mPa the correct

Equ-3.4.8.1 (3) N>s2 326.37835 79.5936167 mPa 256.2364535 81.886989 mPa one.

Red through

(40°3° . +88°2°

49-501 1592

### 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22 86.75

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 42.02948511 mPa Equ-3.4.17 (3) N>s2 48.5865729 mPa

Flange

H/t See3.4.17 16.39285714

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 156.9032732 mPa Equ-3.4.17 (3) N>s2 257.1171799 mPa

AS1664.1:1997-Aluminimum Structures Part 2: limit state design Member beam

5730 Beam

Alloy and tamper Produ	Brodust			Ten	sion		Comp	ressior		Sh	ear			Bea	ring		Mod	ulus of E
	Product	Ftu		Fty		Fcy		Fsu		Fsy		Fbu		Fby		Ε		
6063 T6	Extrusions		207		172		172	TEST	131		96		434		276		70000	
							180											

T5,T6,T7,T8 & T9 onl							
Type of member stress		Intercept		Slope	Intersection		
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591	
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145	
Compression in round tubes under axial end loads	Bt	209.620466	Dŧ	6.71428412	Ct	trial and error	
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674	
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952	
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859	
Ultimate strength of flat plates in compression							
Ultimate strength of flat plates in bending	k1	0.35		2.27			
bending	k1	0.5	k2	2.04			

Table 3.4	/ A \	Dage 1	11
Table 5.4	IAI	Page 2	1.2

Factor of safety	Normal buildings
фу	0.95
φu	0.85
фур	0.9
φb	0.85
фср	0.8
φw	0.9
φς	0.85
φν φcc s	0.8 see below

**RHS/SHS** section properties

Effective Length (m)

3000 mm between restraints

Height

124 mm

Width

67 mm

Walls side (avg if complex shape)

2 mm

Walls top/bottom (average is complex

shape)

4.9 mm

CM (CANTAPORT)

2677900

267.79

Table 3.4 (b) Page 21

kt	1
kc	1.12

ly	737800	73.78
J (Torsion constan	t	
(warp))	1646000	164.6
Zx	43160	43.16
Zy	22020	22.02
Area	1083	10.83
Radius of gyration		
Rx	49.72593401 mm	
Radius of gyration		
Ry	26.10087682 mm	

# Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 234.9894937

Zc 43160 Assumed to be Zx

\$1 1.792654179 \$2 2417.766287 mpa

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<5 140.9406309 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 976.4295549 mPa

#### MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 29.47485103 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 29.47485103 Rye 101.781685

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky < 1 = 1

ky 1 rye 101.7816849 S1 -2.570688695 S2 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<5 140.9108285 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 973.6179716 mPa

40.9743160

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

## NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 57.1 114.2 S1 38.36639146 S2 90.53212769

Equ-3.4.22(1): N<S1 190.06

Equ-3.4.22(2): S1<N<: 184.5331556 Add tripple to one formula

Equ-3.4.22(3): S2>N 213.5418825

#### FLANGE

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 12.85714286

H 63 Add tripple to one formula

S1 12.41378457 S2 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<: 162.6761183 mPa Equ-3.4.17(3): S2>N 327.8244044 mPa

## Compression capacity

## 3.4.8.1-Genreal compression

	k	1
Dc	62.79993051	
S1	0.581870399	
S2	1.241183988	
λχ	0.951803567	
λγ	1.813323043	
	X-X	у-у
φcc limits λ<1.2	0.800121251	0.61920216
φcc limits λ>1.2	0.713252499	0.83386523

X-X Y-Y

Equ-3.4.8.1 (1) N<s1 122.8757635 95.0917604 mPa 109.5352053 128.057874 mPa

Equ-3.4.8.1 (2) s1<n<: 104.2875249 47.2056744 mPa and choise 92.96508208 63.5707896 mPa the correct Equ-3.4.8.1 (3) N>s2 151.9111306 32.3899703 mPa one.

135.4182175 43.6188237 mPa

Red through

1083763

## 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22 57.1

\$1 23.13644439 \$2 39.37218

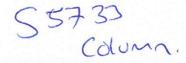
Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 90.43974848 mPa Equ-3.4.17 (3) N>s2 73.81585288 mPa

Flange

H/t See3.4.17 12.85714286

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 162.6761183 mPa Equ-3.4.17 (3) N>s2 327.8244044 mPa



AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Member	beam
Member	beam

T only

Bradust		Tension			(	Compression Shear				Bearing			Modulus of E		
Alloy and tamper	Product	Ftu	I	Fty	I	Fcy	Fsu		Fsy	Fbu	ı	Fby		E	
6063 T6	Extrusions	Total Control	207	The second	172	172		131		96	434		276	1 13	70000
						180									

Table 3.3(D) Page 20

Type of member stress		Intercept		Slope	Intersection		
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Сс	78.6732591	
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145	
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error	
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674	
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952	
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859	
Ultimate strength of flat plates in compression	k1	0.35	k2	2.27			
Ultimate strength of flat plates in bending	k1	0.5		2.04			

Tolo	1- 2	1 1	A 1	Page	21
Tab	IP 3.	4 1	ΑI	Page	/ 1

Factor of safety	Normal buildings
φу	0.95
φu	0.85
фvр	0.9
φb	0.85
фср	0.8
φw	0.9
φς	0.85
φν	0.8
φcc :	see below

RHS/SHS section properties

Effective Length (m)

2750 mm between restraints

Height Width 150 mm 95 mm

Walls side (avg if

complex shape)

1.6 mm

Walls top/bottom (average is complex

shape)

ix

5.6 mm 6621600 CM (CANTAPORT) 662.16 Table 3.4 (b) Page 21

kt	1
kc	1.12

ly	1885900	188.59
J (Torsion constant		
(warp))	3402000	340.2
Zx	88290	88.29
Zy	39700	39.7
Area	1592	15.92
Radius of gyration		
Rx	64.49260797 mm	
Radius of gyration		
Ry	34.41817184 mm	

## Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 191.7113041

Zc 88290 Assumed to be Zx

\$1 1.792654179 \$2 2417.766287 mpa

Equ-3.4.15(1): N<S1 1

Equ-3.4.15(2): S1<N<: 142.9393882 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 1196.855281 mPa

142,39 + 882° CO

## MORE ACCURATE

#### 3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 26.5842941 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 26.5842941 Rye 103.444537

4.9 compression in single web beams and beams having sections containing tubular portions

rye 103.4445372

\$1 -2.570688695 \$2 94.4079109 Equ-3.4.12(1): N<\$1 163.4 mPa

Equ-3.4.12(2): S1<N<: 142.9393863 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 1196.855042 mPa

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 86.75 138.8

**S1** 38.36639146 S2 90.53212769

Equ-3.4.22(1): N<S1

Equ-3.4.22(2): S1<N<5 140.396174 Add tripple to one formula

Equ-3.4.22(3): S2>N 140.5560979

#### FLANGE

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

16.39285714 Limit (N) (b/t)

Н 91.8 Add tripple to one formula **S1** 12.41378457

**S2** 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<5 156.9032732 mPa Equ-3.4.17(3): S2>N 257.1171799 mPa

## Compression capacity

## 3.4.8.1-Genreal compression

1 Dc 62.79993051 **S1** 0.581870399 **S2** 1.241183988 0.672716031 λx 1.260532124 λγ X-X у-у φcc limits λ<1.2 0.858729633 0.73528825

φcc limits λ>1.2 0.674180244 0.7564745

Y-Y

Equ-3.4.8.1 (1) N<s1 131.8763366 112.919268 mPa

103.5348232 116.172869 mPa Equ-3.4.8.1 (2) s1<n<: 126.9771987 81.581349 mPa

99.68855795 83.9319949 mPa Equ-3.4.8.1 (3) N>s2 326.37835 79.5936167 mPa 256.2364535 81.886989 mPa.

Red through and choise the correct

one.

81.58-152

3.4.8.10

Compression flat

plates

Webb plates

H/t See3.4.22

86.75

**S1** 

23.13644439

S2

39.37218

Equ-3.4.17 (1) N<s1

163.4

Equ-3.4.17 (2) s1<n<s 42.02948511 Equ-3.4.17 (3) N>s2 48.5865729

mPa mPa

mPa -

Flange

H/t See3.4.17

16.39285714

**S1** 

23.13644439

**S2** 

39.37218

Equ-3.4.17 (1) N<s1

mPa 163.4

Equ-3.4.17 (2) s1<n<s 156.9032732 Equ-3.4.17 (3) N>s2 257.1171799

mPa

mPa



AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Member beam

T only

Product		Tension		Compression		Shear		Bearing			Modulus of E					
Alloy and tamper	Froduct	Ftu		Fty		Fcy		Fsu		Fsy	F	bu	Fby		E	
6063 T6	Extrusions	Birto.	207		172		172		131	MAIN	96	The sale	434	276		70000
							180									

Table 3.3(D) Page 20

Type of member stress		Intercept		Slope	Intersection		
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591	
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145	
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error	
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674	
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952	
Shear stress in flat plate	Bs	120.834478		0.50203881		98.6818859	
Ultimate strength of flat plates in compression	k1	0.35	k2	2.27			
Ultimate strength of flat plates in bending	k1	0.5		2.04			

Table 3.4 (A) Page 21

Factor of safety	Normal buildings
φγ	0.95
φu	0.85
фvр	0.9
φb	0.85
фср	0.8
φw	0.9
φς	0.85
φν φcc s	0.8 ee below

RHS/SHS section properties

Effective Length (m)

3300 mm between restraints

Height Width

124 mm

Walls side (avg if

67 mm

complex shape)

2 mm

Walls top/bottom (average is complex

shape)

4.9 mm 2677900

CM (CANTAPORT) 267.79

1.12

Table 3.4 (b) Page 21

ly	737800	73.78
J (Torsion constant		
(warp))	1646000	164.6
Zx	43160	43.16
Zy	22020	22.02
Area	1083	10.83
Radius of gyration		
Rx	49.72593401 mm	
Radius of gyration		
Ry	26.10087682 mm	

## **Bending** capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 258.488443

43160 Assumed to be Zx

S1 1.792654179 S2 2417.766287

mpa

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<! 139.9324699 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 887.6632317 mPa

39.99+ W3160

### MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 30.92021187 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 30.92021187 Rye 106.726306

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1 = 1

ky 106.7263062 rye **S1** -2.570688695 **S2** 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 139.8964918 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 884.722143 mPa

3.4.22 Compression in components of bea- flat plates with both edges

supported Page 41

WEBB

NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 57.1 114.2 S1 38.36639146 S2 90.53212769

Equ-3.4.22(1): N<S1 190.06 Equ-3.4.22(2): S1<N<: 184.5331556 Equ-3.4.22(3): S2>N 213.5418825

Add tripple to one formula

FLANGE

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 12.85714286

H 63 Add tripple to one formula

\$1 12.41378457 \$2 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<\$ 162.6761183 mPa Equ-3.4.17(3): S2>N 327.8244044 mPa

## Compression capacity

## 3.4.8.1-Genreal compression

	k	1
Dc	62.79993051	
S1	0.581870399	
S2	1.241183988	
λχ	1.046983924	
λγ	1.994655347	
	X-X	у-у
φcc limits λ<1.2	0.780133376	0.58112238
φcc limits λ>1.2	0.726577749	0.85925175
	X-X	Y-Y

Equ-3.4.8.1 (1) N<s1 119.806197 89.2437936 mPa

 Equ-3.4.8.1 (2) s1
 111.5815829
 131.956519 mPa
 Red through

 Equ-3.4.8.1 (2) s1
 97.01920554
 37.6849912 mPa
 and choise

 90.35890295
 55.7213005 mPa
 the correct

 Equ-3.4.8.1 (3) N>s2
 122.4101073
 25.1223531 mPa
 one.

114.0067366 37.1460929 mPa

37.68 + (083

## 3.4.8.10 **Compression flat** plates

Webb plates

H/t See3.4.22

S1 23.13644439 **S2** 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 90.43974848 mPa Equ-3.4.17 (3) N>s2 73.81585288 mPa

57.1

Flange H/t See3.4.17 12.85714286

S1 23.13644439 S2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 162.6761183 mPa Equ-3.4.17 (3) N>s2 327.8244044 mPa



## 4. HAND CALCULATIONS



ADDRESS:				PROJ #: D 105	116	DES:	DA	TE: 12 / 9 / 16
CLIENT:				SHT #: _(o	f	СНК:	DA	TE:12 /9/16
calculation: PJ	Replaces	urt k		KCP.				COMMENTS / REF
The follows	ny Call Cou	ere a	Cep	Placement	-		~ i.	«K
Sile wind	Speed.							
Vsk - VI	RMJ (MZal	, ms , mb)						
	A - 41ms mt = 1.0 N	12-0.91	1	0.91 × 4	ı =	0.937	Men	Chy.
+ + + + + + + + + + + + + + + + + + + +			+					100
Chro.	21-33	16+124 = 170		1.8-2354 1.8-2441 1.8-2441 1.8-2448	= 0 = 0	550 642 -170	A- 2100 2700 3000	
2.754-3475	7	+		7 40	5 - 0	20 02		
		1.8-2.750					A	vy=9.55° Sy 10
				Noil	U	reny She	ساام	Radion.
AS with Pren	rov cas	Empty	13	/h.				
2.25	= 2.077 $= 2.527$	2100	Ξ	0.58		Une the		net was.
. 321	2700 = 2.121			0.78		Cpu=	77	= 0.641 1 = 0.44 1
2.25	0 = 2571	2700	*	0.95		@ - 180°	0.43	= 0.35 1
· 64 7 - 1.8	3000 = 2.12 = 2.574	3000		0.70		Com = Barnty		
2.950	3300	2000	~	1.22		0+0 -	-03:	0.219 1.
2 2.250	= 2.142 $= 2.592$ $= 3.092$	3300	0	0.93	Transmission on the squares and a samples			- 0.333 小
no point Load		mpacis.			on transaction state and the state of the st	Dead = 0	25 M	Jun2.



Inspect & Investigate

Energy Environmental

ADDRESS:		PROJ #: \$16574	DES:	DATE: 12 15 16
CLIENT:		SHT #: 2_ of	СНК:	DATE: //
CALCULATION	1: Purla knes.			COMMENTS / REF
	Preme fines  Drc = 0.171.2+0.2171.5 =  Drcs = 0.180.9 - 0.641 = 0  0 cost = 0.181.2+ 0.35 =	0.501 1		
Rola	L/W A 0.645 Shan		671	
A	$0H = 0.35 \times 0.871^{2} = 0$ $2$ $0.35 \times 2.0^{2} = 0.17$	.13 Z much	0.32 há	١٠٠٠ر
В	$OH = 0.32 \times 1.22i^2 = 0.2i$			
	$\frac{1}{8}$		0.36 ks.	a on
	Mode Mere Mere.	2.814.		



Inspect & Investigate

Energy Assessment Environmental

ADDRESS:	PROJ #: \$10516 DES: DATE: 1 / 12/	16
CLIENT:	SHT #: 2 of CHK: DATE: / /	·
CALCULATION:	COMMENTS/	REF
5.53 5.53 5.53 5.53 5.53 5.53 5.53 5.53	223 223 233 2430	
De 8385  Sommons Cal'S  Rean  8.63 hom 4:11  104 ho 25  116 129 40:15  129 6:03  129 6:03  129 6:03  129 5:23  129 5:23  129 5:23  129 5:23	4858 30 5858 30 5858 30 585830 585830	60 10
S	156834 156834 156834 156834	Co LCD DTR



Residential Geotechnical Commercial & Infrastructure

Inspect & Investigate	Energy Assessment	Environmenta
irivestigate	Assessment	

ADDRESS:				PROJ #:D 105116	DES:	DATE: 1 / 12 / 16
CLIENT:				SHT #: 3_ of	_ CHK:	DATE: //
CALCULATION	V: Ma	an Pan	e. 03000			COMMENTS / REF
				St 2750.	0	
Was		7 3 + 1.22	(= 2.971	<u> </u>	Physical Reports 143	
700					50'	33
CASE	A =		0695	- 1.42 V	57	33
	B =	2.87	× 0551	= 1.58 1		
	65		0.47	= 1.34 V.		
Moliti	Fa	ne Resul	<u>K</u>			
Beams		BM	SF	Aan.		
CASE	A	6.655	4:134	0.372		b Fromm.
	ß	7.04	4.39	0.27 T		Recin.
		6.28	4:09	०७९८		
Post	Α	9.068	0.87	14.180	Post 40.390	
	ß	10.01	0.97	G73T	Consecul	
	C	8.58	0.82	4:01 C.		
4330		Ream		2.66		
Beam	0557 x	(1340.050)=	0.82 3300	-0.150-0.494) =	2.914 Varia	C 411 or
5033 Begin C	551 Y	(1.775, 778	)- 089 x 2	.662 =	3.16 kp.n	25.19
5723						
Ream	D.551	( 2.0 - 0.87	() = 1.03 ×2	662	3.64 Via. n	( 6.03 m.n
						-



ADDRESS:				PROJ #:0 105116	DES:	DATE: 1 / 12 / 16		
CLIENT:				SHT #: of	снк:	DATE: //		
CALCULATIO	N: /	uain fr	an 3000			COMMENTS / REF		
	hler	3300	Post- 0.871 - 10		Peper 4330 5030			
CASE		= 1,0	0.495	- 0926 d	573			
Mull+	C	a Results	0.61	= 0.76 U.				
Beams		Bm	SF	Axial.				
	A	5.24	3.10	0.26				
	B	5.8	3-4	0.29 T	ASH 8.63	ks. u vin		
	C	4.31	2.48	0.216		week her last		
posts	A	6.914	0.69	3.050				
	B	7.19	06	7.581				
	(	5 67	0.49	250.				
4330 Bean -	- 0.	551 v (26	-0.850 1·18 L ×	( ) - 010-0682)	- 3.73			
	-0.551	× (29 +	d.067 = 438	~2.36	= 3.85	( 5.23		
5720 Rean = .	0551	(33 -, )	22( 15 1.58 17	200	= 4.40	6.0812.m		
Fals		8×1.1×1.		7 = 11-49 NA. M				
Pile (a		05.09.	2.13 x · 33 x 17 =		10.09 = 3.	70 120 02		



## 5. PURLINS

## AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Member beam

T only

Alloy and tamper	Product		Tens	ion	Co	mpression	ł	Sh	ear			Bea	ring		Modu	ilus of E
	Product	Ftu	I	Fty	Fcy	1	Fsu		Fsy		Fbu		Fby		E	
6063 T6	Extrusions		207	NE JES	172	172		131		96		434		276		70000
						180										

Table 3.3(D) Page 20

Type of member stress		Intercept		Slope	Intersection		
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591	
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145	
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error	
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674	
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952	
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859	
Ultimate strength of flat plates in compression				ω.			
Ultimate strength of flat plates in bending	k1	0.35		2.27			

Table 3.4 (A) Page 21

Factor of safety	Normal buildings
φγ	0.95
φu	0.85
фvр	0.9
φb	0.85
фср	0.8
φw	0.9
фс	0.85
φv φcc s	0.8 ee below

RHS/SHS section properties

Effective Length (m)

3300 mm between restraints

Height Width 46 mm 25 mm

Walls side (avg if complex shape)

0.9 mm

Walls top/bottom (average is complex

shape)

lx

1.1 mm 58000 CM (CANTAPORT) 5.8 Table 3.4 (b) Page 21

kt	1
kc	1.12

ly	21300	2.13
J (Torsion constan	t	
(warp))	33000	3.3
Zx	2510	2.51
Zy	930	0.93
Area	175	1.75
Radius of gyration		
Rx	18.2051798 mm	
Radius of gyration		
Ry	11.03241976 mm	

# Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 624.8429662

Zc 2510 Assumed to be Zx

\$1 1.792654179 \$2 2417.766287 mpa

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<: 127.9143355 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 367.2133626 mPa

#### MORE ACCURATE

#### 3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 48.11371833 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 48.11371833 Rye 68.5875071

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky < 1 = 1

ky 1 rye 68.58750715 S1 -2.570688695 S2 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<5 127.8302973 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 365.3877444 mPa

127 +2510

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 48.66666667 43.8 S1 38.36639146 90.53212769

Equ-3.4.22(1): N<S1 190.06

Equ-3.4.22(2): S1<N<! 197.0870132 Add tripple to one formula

Equ-3.4.22(3): S2>N 250.5460581

#### **FLANGE**

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 21.09090909

23.2 Add tripple to one formula

S1 12.41378457 S2 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<: 149.2326515 mPa Equ-3.4.17(3): S2>N 199.8436948 mPa

## Compression capacity

### 3.4.8.1-Genreal compression

	k	1
Dc	62.79993051	
S1	0.581870399	
S2	1.241183988	
λχ	2.859749483	
λγ	4.719023991	
	X-X	у-у
φcc limits λ<1.2	0.399452609	0.00900496

96 φcc limits λ>1.2 0.95 0.95

X-X Y-Y Equ-3.4.8.1 (1) N<s1 61.34450774 1.38290487 mPa

145.8928571 145.892857 mPa Equ-3.4.8.1 (2) s1<n<: 4.202553166 -0.9567009 mPa

and choise 9.99474136 -100.92945 mPa the correct Equ-3.4.8.1 (3) N>s2 8.401130445 0.06955141 mPa one.

19.98002705 7.33749269 mPa

Red through

## 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22 48.66666667

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 104.2090533 mPa Equ-3.4.17 (3) N>s2 86.60723012 mPa

Flange

H/t See3.4.17 21.09090909

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 149.2326515 mPa Equ-3.4.17 (3) N>s2 199.8436948 mPa

### Member T only

	Dundunt	Tension		Compression Shear		ear	r Bearing		Bearing	Modulus of E				
Alloy and tamper	Product	Ftu	Fty		Fcy	Fsu		Fsy		Fbu	Fby		E	
6063 T6	Extrusions		207	172	17	2	131	ELEVAN.	96	4	34	276		70000
					18	0								

Table 3.3(D) Page 20

Table 3.4 (	A) Page 21
-------------	------------

Type of member		Intercept		Slope	le le	tersection	
stress		mtercept		зюре	intersection		
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591	
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145	
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error	
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674	
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952	
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859	
Ultimate strength of flat plates in compression	k1	0.35	k2	2.27			
Ultimate strength of flat plates in bending	k1	0.5		2.04			

Factor of safety	Normal buildings
фу	0.95
φu	0.85
φνρ	0.9
φb	0.85
фср	0.8
φw	0.9
φς	0.85
φν	0.8
фсс	see below

RHS/SHS section properties

Effective Length (m)

2750 mm between restraints

Height Width 150 mm 95 mm

Walls side (avg if complex shape)

1.6 mm

Walls top/bottom (average is complex

shape)

ix

3.4 mm 4750400 CM (CANTAPORT) 475.04 Table 3.4 (b) Page 21

kt	1
kc	1.12

1610200	161.02
3148000	314.8
63340	63.34
33900	33.9
1215	12.15
62.52834748 mm	
36.40422351 mm	
	3148000 63340 33900 1215 62.52834748 mm

# Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 154.7331887

Zc 63340 Assumed to be Zx

 S1
 1.792654179

 S2
 2417.766287

mpa

Equ-3.4.15(1): N<S1 163.4 mPa Equ-3.4.15(2): S1<N<\$ 144.834964 mPa Equ-3.4.15(3): S2>N 1482.879585 mPa

## MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 23.88818404 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 23.88818404 Rye 115.119676

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1 = 1

ky 1 rye 115.1196757

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

## NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 89.5 143.2 S1 38.36639146 S2 90.53212769

Equ-3.4.22(1): N<S1 190.06 Equ-3.4.22(2): S1<N<5 136.3025247 Equ-3.4.22(3): S2>N 136.2373351

## FLANGE

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 27 H 91.8 S1 12.41378457 S2 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<\$ 139.5847376 mPa Equ-3.4.17(3): S2>N 156.1068592 mPa

## Compression capacity

## 3.4.8.1-Genreal compression

	k	1
Dc	62.79993051	
S1	0.581870399	
S2	1.241183988	
λχ	0.693848678	
λγ	1.191763127	
	X-X	у-у
φcc limits λ<1.2	0.854291778	0.74972974
φcc limits λ>1.2	0.677138815	0.74684684

X-X Y-Y Equ-3.4.8.1 (1) N<s1 131.1948087 115.137068 mPa

103.9891752 114.694336 mPa Equ-3.4.8.1 (2) s1<n<: 125.187234 86.4215032 mPa 99.22738052 86.0891901 mPa

Equ-3.4.8.1 (3) N>s2 305.2144862 90.7931949 mPa 241.9227025 90.4440715 mPa Red through and choise

the correct one.

## 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22 89.5

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 37.53949441 mPa Equ-3.4.17 (3) N>s2 47.09368938 mPa

Flange

H/t See3.4.17 27

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 139.5847376 mPa Equ-3.4.17 (3) N>s2 156.1068592 mPa

3300 Purlin. Sam krown.

AS1664.1:1997-Aluminimum Structures Part 2: limit state design

Member	beam			Sal	ne Ro
Tonly					
	Product	Tension	Compression	Shear	В

	. Product		Tensio	n	Compressio	r	Shea	r		Beari	ng	Mod	ulus of E
Alloy and tamper	Ftu	Ft	у	Fcy	Fsu	Fs	у	Fbu	FI	by	E		
6063 T6	Extrusions		207	172	172		131	96		434	276		70000
					180	)							

Table 3.3(D) Page 20

Type of member stress		Intercept		Slope	Intersection	
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859
Ultimate strength of flat plates in compression						
Ultimate strength of flat plates in bending	k1 k1	0.35		2.27		

Table	3.4	(A)	Page	21

Factor of safety	Normal buildings
φу	0.95
φu	0.85
фvр	0.9
φb	0.85
фср	0.8
φw	0.9
φε	0.85
φν	0.8
	ee below

RHS/SHS section properties
Effective Length /

Effective Length (m)

1300 mm between restraints

Height Width 46 mm 25 mm

Walls side (avg if complex shape)

0.9 mm

Walls top/bottom (average is complex

shape)

1 mm 53300 CM (CANTAPORT) 5.33

Table 3.4 (b)	Page 21
kt	

ly	20700	2.07
J (Torsion constant		
(warp))	32000	3.2
Zx	2270	2.27
Zy	910	0.91
Area	164	1.64
Radius of gyration		
Rx	18.02775638 mm	
Radius of gyration		
Ry	11.23474576 mm	

## Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 229.3184741

Zc 2270 Assumed to be Zx

\$1 1.792654179 \$2 2417.766287

mpa

Equ-3.4.15(1): N<S1 163.4 mPa Equ-3.4.15(2): S1<N<\cdrt 141.1913909 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 1000.576546 mPa

MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 29.11491648 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 29.11491648 Rye 44.6506519

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1 = 1

ky 1 rye 44.65065188

S1 -2.570688695 S2 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 141.1634262 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 997.8395699 mPa

141 4 2270

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

#### NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 48.88888889

S1 38.36639146 S2 90.53212769

Equ-3.4.22(1): N<S1 190.06

Equ-3.4.22(2): S1<N<5 196.7562133 Add tripple to one formula Equ-3.4.22(3): S2>N 249.4072123

#### FLANGE

1

Red through

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 23.2

Н 23.2 Add tripple to one formula

**S1** 12.41378457 S2 56.24597143

163.4 mPa Equ-3.4.17(1): N<S1 Equ-3.4.17(2): S1<N<: 145.7890884 mPa Equ-3.4.17(3): S2>N 181.6760862 mPa

## Compression capacity

#### 3.4.8.1-Genreal compression

Dc 62.79993051 0.581870399 S1 **S2** 1.241183988 1.1376553 λx 1.825530639 λγ у-у 0.761092387 0.61663857 φcc limits λ<1.2

φcc limits λ>1.2 0.739271742 0.83557429

Y-Y X-X

Equ-3.4.8.1 (1) N<s1 116.8820451 94.6980655 mPa 113.5310175 128.320337 mPa

Equ-3.4.8.1 (2) s1<n<: 90.31744486 46.5374979 mPa and choise 87.72802875 63.0605008 mPa the correct one.

Equ-3.4.8.1 (3) N>s2 101.1450039 31.8259134 mPa 98.2451599 43.1256111 mPa

## 3.4.8.10 Compression flat

plates

Webb plates

H/t See3.4.22 48.88888889

S1 23.13644439 S2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 103.8462258 mPa Equ-3.4.17 (3) N>s2 86.21356089 mPa

Flange

H/t See3.4.17 23.2

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 145.7890884 mPa Equ-3.4.17 (3) N>s2 181.6760862 mPa Member beam

T only



Alloy and tamper	Product	Tension			Compression		Shear		Bearing			Modulus of E					
	roduct	Ftu	108	Fty		Fcy		Fsu		Fsy		Fbu		Fby		E	
6063 T6	Extrusions		207		172		172	1000	131		96		434	No. of the last	276		70000
6063 16	Extrusions	1000	207		172		172				96		434		276		

Table 3.3(D) Page 20

Type of member stress		Intercept		Slope	Intersection			
Compression in columns and beam flanges	Вс	190.112849	Dc	0.99075936	Cc	78.6732591		
Compression in flat plates	Вр	216.080333	Dp	1.20053227	Ср	73.7947145		
Compression in round tubes under axial end loads	Bt	209.620466	Dt	6.71428412	Ct	trial and error		
Compressive bending stress in solid rectangular bars	Bbr	317.096705	Dbr	2.61387132	Cbr	80.8753674		
Compressive bending stress in round tubes	Btb	329.59479	Dtb	142.532382	Ctb	0.78029952		
Shear stress in flat plate	Bs	120.834478	Ds	0.50203881	Cs	98.6818859		
Ultimate strength of flat plates in compression	k1	0.35	k2	2.27				
Ultimate strength of flat plates in bending	k1	0.5		2.04				

Table 3.4 (A) Page 21

Normal buildings
0.95
0.85
0.9
0.85
0.8
0.9
0.85
0.8

RHS/SHS section properties

Effective Length (m)

3300 mm between restraints

Height Width

46 mm 25 mm

Walls side (avg if complex shape)

0.9 mm

Walls top/bottom (average is complex

shape)

lx

1.6 mm 66100 CM (CANTAPORT) 6.61

C

Table 3.4 (b) Page 21

kt	1
kc	1.12

ly	22300	2.23
J (Torsion constant		
(warp))	36000	3.6
Zx	2830	2.83
Zy	970	0.97
Area	193	1.93
Radius of gyration		
Rx	18.50640556 mm	
Radius of gyration		
Ry	10.74914143 mm	

# Bending capacity

3.4.15-Compresion in beams, extreme fibre, gross section -RHS and SHS page 37

Limits (N) 659.2144054

Zc 2830 Assumed to be Zx

\$1 1.792654179 \$2 2417.766287 mpa

Equ-3.4.15(1): N<S1 163.4 mPa

Equ-3.4.15(2): S1<N<: 127.0003559 mPa Add tripple to one formula

Equ-3.4.15(3): S2>N 348.0668578 mPa

126 428,0

### MORE ACCURATE

3.4.12 - Compression METHOD

in beams, extreme fibre, gross section single web beams bent about strong axis Page 35

limts (N) 49.41973706 Note Clause Ry=Rye Page 37 Bottom Para

Rye limit 49.41973706 Rye 66.7749405

4.9 compression in single web beams and beams having sections containing tubular portions

Cb 1 Note if Ky<1 = 1

ky 1 rye 66.77494046 S1 -2.570688695 S2 94.4079109 Equ-3.4.12(1): N<S1 163.4 mPa

Equ-3.4.12(2): S1<N<: 126.9137492 mPa Add tripple to one formula

Equ-3.4.12(3): S2>N 346.3306743 mPa

3.4.22 Compression in components of bea- flat plates with both edges supported Page 41

WEBB

## NOTE AMMEND SIDE WALLS FOR ODD SHAPES

Limit (N) (h/t) 47.5555556 42.8 **S1** 38.36639146 S2 90.53212769

Equ-3.4.22(1): N<S1 190.06 Equ-3.4.22(2): \$1<N<! 198.7410129

Equ-3.4.22(3): S2>N 256.3999379

#### FLANGE

Add tripple to one formula

3.4.17 compression in components of beams gross section flat plates Page 38

NOTE AMMEND TO SUIT DIFFERING TOP OR BOTTOM WALLS FOR ODD SHAPES

Limit (N) (b/t) 14.5

Н 23.2 Add tripple to one formula

S1 12.41378457 S2 56.24597143

Equ-3.4.17(1): N<S1 163.4 mPa Equ-3.4.17(2): S1<N<: 159.9937862 mPa Equ-3.4.17(3): S2>N 290.6817379 mPa

## Compression capacity

### 3.4.8.1-Genreal compression

Dc 62.79993051 **S1** 0.581870399 **S2** 1.241183988 2.813201805 λx λγ 4.843387154 X-X φcc limits λ<1.2 0.409227621 -0.0171113

φcc limits λ>1.2 0.95 0.95

X-X Y-Y Equ-3.4.8.1 (1) N<s1 62.84567036 -2.6278072 mPa

145.8928571 145.892857 mPa

Red through Equ-3.4.8.1 (2) s1<n<: 5.501644408 1.95157018 mPa and choise 12.77177277 -108.34895 mPa the correct Equ-3.4.8.1 (3) N>s2 8.893887077 -0.1254623 mPa one.

1

20.64668241 6.9655222 mPa

### 3.4.8.10 Compression flat plates

Webb plates

H/t See3.4.22 47.5555556

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 106.0231909 mPa Equ-3.4.17 (3) N>s2 88.63076354 mPa

Flange

H/t See3.4.17 14.5

\$1 23.13644439 \$2 39.37218

Equ-3.4.17 (1) N<s1 163.4 mPa Equ-3.4.17 (2) s1<n<s 159.9937862 mPa Equ-3.4.17 (3) N>s2 290.6817379 mPa